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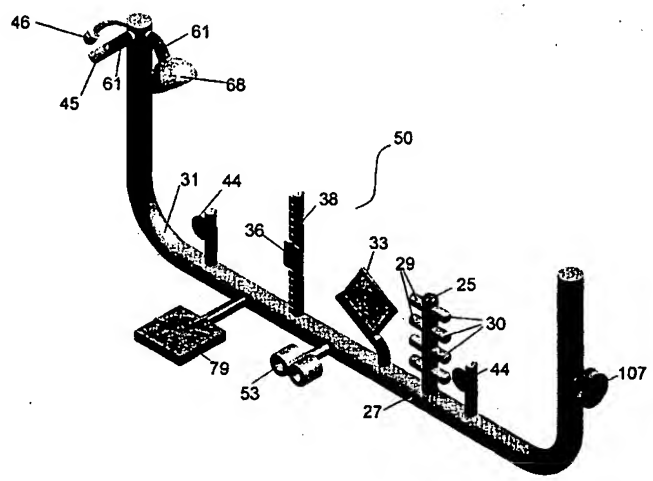

(57) Abstract: The present invention relates to structural elements for forming structures with electric connections and circuits. The structural elements preferably perform a plurality of functions such as supporting and suspending of a spatial structure comprising a plurality of structural elements, establishment of a conducting network by connecting structural elements, and forming and holding electric and/or optical circuits. The conducting network may conduct electricity, electric signals, light, light signals and fluids such as gas or water. The electric and/or optical circuits comprise electric and/or optical components held on one or more interconnected elements. The elements according to the present invention comprise an elongated tubular, electrically insulating first member having a longitudinal axis and an outer surface area holding one or more electric conductors connected to one or more electric components thereby forming one or more electric circuits, an elongated tubular, second member having a longitudinal axis and an outer surface area, wherein the first and the second member co-extend co-axially, one arranged at least partly within the other.

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AN ELEMENT FOR HOLDING ELECTRIC CIRCUITS

The present invention relates to structural elements for forming structures with electric connections and circuits. The structural elements preferably perform a plurality of functions such as supporting and suspending of a spatial structure comprising a plurality of structural elements, establishment of a conducting network by connecting structural elements, and forming and holding electric and/or optical circuits. The conducting network may conduct electricity, electric signals, light, light signals and fluids such as gas or water. The electric and/or optical circuits comprise electric and/or optical components held on one or more interconnected elements.

The present invention provides structural elements holding one or more electric components and electrical conductors connecting those components. The electric components may be simple components such as components providing resistance, inductance or capacitance in an electric circuit. The components may also have a larger degree of functionality such as switches, diodes and transistors, or microprocessors, processors, digital storage etc. The electric components may also constitute part of a device for providing an output, receiving input or performing a function.

The present invention also provides a structural element comprising a first elongated tubular member having inner walls and a second elongated tubular member having outer walls, at least one cavity defined between the inner and the outer walls, and a compact material filling at least one such cavity.

When the compact material is an electrically insulating material the members in the structural members may perform as one or more electric conductors. When the compact material is a transparent material functioning as a light conducting material, the structural element may also function as light conducting fibres. A cavity defined by an inner surface of an element, e.g. by the inner surface of the innermost element, provides a duct, pipe or channel for conducting gas or liquid. Reipur describes such structural elements in WO 99/49476.

The structural elements according to the present invention may be interconnected so as to form connections between pairs of members, cavities or filled cavities of each element.

These connections may be performed so as to form connections only between selected members and/or (filled) cavities of each element.

Thus, connecting elements in a durable connection comprising connections between members or filled cavities of each element provides a both a structure and a network of conductors.

The electric components of the elements are preferably adapted to utilise and control electric and optical signals as well as to utilise and control conducted power, light and fluids. Single components as well as structures of two or more interconnected elements may establish a functional device for providing an output, receiving input or performing a function.

By connecting co-operating units and forming communication and transport lines, a set of interconnected structural elements thereby provides function, control, communication, transport and structure for a system.

In a first aspect, the present invention provides an element for holding one or more electric circuits, the element comprising:

an elongated tubular, electrically insulating first member having a longitudinal axis and an inner and outer surface area, and

an elongated tubular, second member having a longitudinal axis and an outer surface area,

wherein the first and the second member co-extend co-axially, one arranged at least partly within and radially spaced from the other, and

wherein the element further comprises one or more electric circuits comprising one or more electric components and one or more electric conductors connected to the one or more components, the conductors being provided at a surface area of the first member.

Optionally, other members of the element have electric circuits provided at a surface. The circuits are preferably provided on the outer surfaces since the outer surface is easier accessible.

It is an important feature that the first member is electrically insulating. By providing an electrically insulating first member having electrical conducting material on the outer surface area, the conductors can be worked into the one or more electrical circuits by removing conducting material from, or forming extra conducting material on, the outer surface areas of the first member. Such processing allows electric circuits to be formed directly on the first member, preferably in a fabrication process similar to the processing of electronic chips or printed circuit boards. If the first member where an electrical conductor, the circuits provided on its outer surface area would be short-circuited unless the circuits where held by an insulating layer formed between first member and the conductors of the circuit.

Also, when combining elements by making connections between members, it is an advantage that electrical contact is not necessarily established between members from different elements. By combining two elements according to the first aspect, electrical contact may be established between the first members depending upon whether the connecting parts of the first members holds conducting material. Thus, electrical contact may or may not be formed, and, two or more electrical connections may be formed if both first members holds a number of conductors leading to the connecting parts of the first members in an appropriate configuration. Optionally, an elongated tubular metal member may be comprised in the element in order to improve the strength and durability of the element.

In the present claims and description, the term circuit and electric circuit are both to be interpreted as a path for conducting electric current. Preferably, the path comprises a sequence of one or more electric components and electric conductors for carrying and electric current.

With the term component or electric component is meant any component adapted to form part of an electric circuit, and which provides an effect in excess of conducting electric current. Such as component may be a resistor, a capacitor or a coil, all of which may

substantially consist of electric conductors but which also provides an effect in the form of impedance such as resistance, capacitance or inductance.

The tubular members may have any cross-sectional shape, such as circular or polygonal, and the tubular member may have a uniform cross-section along its total length, or the size and/or shape of the cross-section may vary along the length of the tubular member.

conductors are formed by a conducting material such as metal, metal alloys, semiconducting materials, conducting ceramics, conducting liquids, conducting polymers such as conducting adhesives or conducting plastics. The conductors are preferably formed as one or more layers covering one or more parts of the surface area of a member. These layers may be made and later processed in a fabrication process similar to the fabrication of electronic chips or printed circuit boards. The thickness of such layers is preferably within the interval 1-120μm, such as within the interval 18-105μm or 35-70μm.

The first and the second member are at least substantially fixed in relation to each other. Further the cavity defined between an inner surface of the outer member and the outer surface area of the inner member may be filled with a compact mass of material in order to separate the members.

The second element may be either electrically conducting or electrically insulating. The inner surface of either of the members may comprise one or more electrically conducting layers. These layers can serve to shield the circuits of the element from electromagnetic radiation from the surroundings or from other circuits held by the element. Such layers are preferably formed by metallizing electrically insulating members.

The electric conductors of the circuits have preferably been formed on the outer surfaces by deposition of conducting material thereon. Alternatively, at least some of the electric conductors have been formed by ion implantation in the outer surfaces. The electric components on the outer surfaces are preferably surface mount devices fastened using solder or conductive adhesives. Alternatively, they are fastened using flip chip technology and anisotropic conducting adhesives.

The electric components may be components such as resistors, capacitors, coils, diodes, transistors, integrated circuits, thyristors, inductors, switches, antennas and photonic components. The circuits formed by the electric conductors and components may be circuits such as operational amplifiers, microprocessors, processor, electric storage, magnetic storage, RAM, ROM, EEPROM, neural networks, power supplies, receivers, transmitters.

The electric circuits must have some power supply, and are preferably connected to a battery or another power supply either through a conductor provided on the member holding the circuit, or on through another member designated to supply power to some or all of the circuits.

The element may be adapted to form connections to other elements, wherein pairs of individual members from the connected elements are connected. For that purpose, the element preferably comprises one or more connection portions having one or more conductors exposed. The connection portions may be concave as in a female connector or convex as in a male connector.

By connecting an element comprising a circuit to an element comprising one or more conductors, it is possible to expand the circuit. Hence, specific combinations of elements may form new circuits that can provide extended or different functionality.

Thus, according to a second aspect, the present invention may provide a system of electric circuits comprising:

a first element according to the first aspect, said first element comprising at least one exposed conductor connected to at least one of the one or more electric circuits, and

a second element comprising one or more electric conductors whereof at least one conductor is exposed,

wherein one of the first or second elements comprises a recess comprising an exposed conductor of the element, and the other of the first or second element comprises a first part for introduction into said recess, said first part comprising an exposed conductor of the element, and wherein introduction of the first part into the recess establishes an

electrically conducting connection between the exposed conductor of the first element and the exposed conductor of the second element.

Hence, such a system comprises at least a first element according to the first aspect of the present invention. Preferably, the second element, which is connected to the first element, is also a tubular element comprising one or more members. Optionally, the second element is also an element according to the first aspect.

However, the second element may also be a different type of element, such as a flat element having an at least substantially planar first surface, and comprising two or more layers of conducting material. Such a flat element also has the advantages of a layered structure, such as high supporting strength and the wiring, guiding and piping properties.

The layers of the flat element preferably have an extent substantially corresponding to the extent of the first surface, which is at least substantially parallel to and of the at least substantially same size and position. Moreover, the layers are preferably separated by an at least substantially electrically insulating material. Optionally, the flat element further comprises one or more channels or ducts for holding and/or conducting a gas or a liquid through the element. Such channels or ducts preferably forms a continuous network extending in a plane at least substantially parallel to the first surface.

The tubular first element, or any other tubular element, may be connected to the second, flat element by plugging a male part of the tubular element into a female site of the flat element. For this reason, the second, flat element may comprise the recess comprising an exposed part of one or more conducting layers of the second element. Correspondingly, the first tubular element may comprise the first part for introduction into the recess of the second, flat element, said first part comprising an exposed conductor connected to at least one of the one or more circuits of the first element. Thereby, the circuitry of the first element can be connected to one or more members of the flat element.

Alternatively, it is the flat element, which is inserted into the tubular element. For this purpose the first tubular element may comprise one or more recesses at least one of which comprises an exposed conductor connected to at least one of the one or more circuits of the first element. Correspondingly, the second, flat element may comprise one or more first parts for introduction into one or more of the recesses of the first element, at

least one of said first parts comprising an exposed part of one or more conducting layers of the second element. Again, the circuitry of the first element can be connected to one or more members of the flat element.

The system may be further extended by connecting a third element to the second element. The third element comprises one or more electric conductors whereof at least one conductor is exposed. For that purpose, the second element may comprise at least two exposed conductors since it forms connections to both the first and the third element. Either one of the second or third elements comprises a recess comprising an exposed conductor, whereas the other element comprises a first part for introduction into said recess, said first part comprising an exposed conductor of the element. The introduction of the first part into the recess establishes an electrically conducting connection between the exposed conductor of the third element and the exposed conductor of the second element. It is important to notice that the second element can be any element.

Having three elements connected, at least one conductor of the second element preferably provides an electrical connection between one or more circuits of the first element and one or more conductors of the third element. Preferably, the third element is also an element according to the first aspect of the invention.

The system according to the second aspect forms a network of conductors connecting different elements and preferably different circuits in different elements. Preferably, the electrically conducting connections formed between elements in the network are adapted to conduct electric signals such as digital or analogue signals between elements.

Preferably, some connections comprise connections between at least two pairs of conductors of two elements. Thereby, by connecting one of the elements to an electric power supply, the at least two electrically conducting connections may supply electric power to one or more electric circuits of the other element.

When the elements are assembled, they provide a specific circuit configuration, and when they are assembled differently, the circuit configuration provided may also be different. In a third aspect, the present invention provides a set of elements to be connected in at least two different ways. Preferably, at least one element is an element according to the first aspect. However, the elements and the connections formed are characterised in that if

two elements can be connected in two ways, connecting them in those two different ways will produce different situations even though the two connections may at a first glance seem identical.

The different situations produced by assembling the elements according to the third aspect differently may result in different functions provided by, or a different output given by, the assembly. Alternatively, the assembly may respond differently in the two situations. This property, although illogical at first, allows a number of elements according to the third aspect to provide a number of functions, outputs or responds, which exceeds the number of functions, outputs or responds provided by an identical number of other elements. Hence the elements according to the third aspect provides an unexpectedly large functionality.

The set of elements according to the third aspect may be used as a toy, tool, or any machine or appliance adapted to perform different functions, give different outputs or respond differently when assembled differently. Alternatively it may be used to for testing e.g. intelligence quotient or combinatory capabilities of humans, animals or machines.

According to the third aspect of the present invention, the set of elements comprise a first element according to any of claims 1 to 21, the first element comprising a first and a second connection portion for connecting one or more electric circuits of the first element to one or more electric circuits of the second element, each connection portion comprising one or more exposed conductors connected to one or more circuits of the first element. The set further comprises a second element comprising two or more electric conductors, the second element comprising a third connection portion comprising one or more exposed conductors. Hence, the element according to the first aspect may comprise two or more connection portions whereas the other element may comprise one or more. Thereby the two elements can be assembled in at least two different ways, wherein the first and the third connection portions are adapted to engage each other so as to electrically connect one or more of the exposed conductors of the first connection portion to one or more of the exposed conductors of the third portion so as to form a first circuit from one or more of the circuits of the first element and at least one of the conductors of the second element,

the second and the third connection portions are adapted to engage each other so as to electrically connect one or more of the exposed conductors of the second connection portion to one or more of the exposed conductors of the third portion so as to form a second circuit from one or more of the circuits of the first element and at least one of the conductors of the second element, and
wherein the first and the second circuits provides different functions/functionality/effects/outputs/ responds etc.

Similarly, the element according to the first aspect may comprise one or more connection portions whereas the other element may comprise two or more. Thereby the situation is reversed but the two circuits are preferably still different.

Optionally, the second element may also be an element according to the first aspect, whereby its exposed conductors are preferably connected to one or more of the circuits. In this case, the first and the third connection portions are adapted to engage each other so that the first circuit connects one or more of the circuits of the first element to one or more of the circuits of the second element, and the second and the third connection portions are adapted to engage each other so that the second circuit connects one or more of the circuits of the first element to one or more of the circuits of the second element.

Typically, elements are tubular elements and the connection portions are end portions, hence the different assemblies are established by changing the order in which the elements are connected. The varying functions, outputs or responds provided when the elements are assembled differently can be unpredictable and possibly surprising, especially if the elements look at least substantially identical.

BRIEF DESCRIPTION OF FIGURES

Figure 1 shows perspective views and cross sectional views of elements according to the first embodiment of the present invention.

Figure 2A-E are perspective views of elements comprising a plurality of individual conductors according to a preferred embodiment of the present invention.

Figure 3 shows exploded views of an element comprising electrical circuits according to the first embodiment of the present invention.

Figure 4 is a close up of a member of an element according to the first embodiment of the present invention.

Figure 5 shows fully and partially metallized members of an element according to the first embodiment of the present invention.

Figure 6 shows a computer according to the second embodiment of the present invention.

Figure 7 is two perspective views of keyboards according to the second embodiment of the present invention.

Figure 8 is a perspective view of a system according to the third embodiment of the present invention.

Figure 9 shows perspective views of a T-piece and an X-piece element according to the third embodiment of the present invention.

Figure 10 shows general examples of elements according to the third embodiment of the present invention.

Figure 11 shows perspective views of flexible elements according to the third embodiment of the present invention.

Figure 12 is a close up of a flexible element from Figure 11.

Figure 13 shows a rotatable connection according to the third embodiment of the present invention.

Figure 14 shows different examples of light emitting elements according to the third embodiment of the present invention.

Figure 15 shows different examples of speaker elements according to the third embodiment of the present invention.

Figure 16 shows different examples of camera elements according to the third embodiment of the present invention.

Figure 17 shows different examples of microphone elements according to the third embodiment of the present invention.

Figure 18A and C are cross sectional views of battery elements according to the third embodiment of the present invention. Figure 18B shows anodes/cathodes in batteries according to the prior art.

Figure 19 shows different examples of functional elements according to the third embodiment of the present invention.

Figure 20 shows different examples of mechanical contact elements according to the third embodiment of the present invention.

Figure 21 shows different examples of motor elements according to a fourth embodiment of the present invention.

Figure 22 shows a rotatable connection according to the fourth embodiment of the present invention.

Figure 23 is a perspective view of a system based on a self-supporting structure according to a fifth embodiment of the present invention.

Figure 24 shows a system based on a flat element according to the fifth embodiment of the present invention.

Figure 25 is perspective and cross sectional views connection between tubular and flat elements according to the fifth embodiment of the present invention.

Figure 26 is a perspective view of a one storey building build according to the fifth embodiment of the present invention.

Figure 27 is a perspective view of a three-storey building having through going pillars according to the fifth embodiment of the present invention.

Figure 28 is a perspective view of functional elements connected to a pillar of the building of Figure 27

Figure 29 is an illustration of a toy according to a seventh embodiment of the present invention.

Figure 30 shows a densist tool based on elements according to the present invention.

DETAILED DESCRIPTION

Figure 1 shows a structural element 6 comprising a plurality of elongated tubular members 9. The members 9 are separated by an electrically insulating, compact material 10 filling the cavities defined between the members.

The tubular members 9 can be formed in any hard material such as plastic, polymers, silicon-based materials, metals and metal alloys, ceramics, fibre glass, carbon fibre compounds etc. The compact material 10 may be of a material having a specific weight, which is substantially smaller than the specific weight of the member material. The relationship between bending strength and weight is much more favourable for a tubular member than for a solid rod-shaped member having the same cross-sectional size and shape. This means, that two relatively thin-walled tubular members arranged co-axially within each other and separated by such compact material, may obtain substantially the same bending strength as a corresponding solid member, while the weight of the composite element comprising the members and the filling material may be substantially smaller than the weight of a corresponding solid member.

The tubular members 9 are preferably either electrically conducting or electrically insulating but with one or more electric conductors provided on the outer and/or inner surface. Optionally, a tubular member is an electrically insulating tubular body with metallized inner and outer surfaces, whereby a member provides two electrically conducting, tubular sheets providing the same electrical properties as two conducting members. In this description, forming an electric connection to a member it is not intended to imply that the member itself is formed by an electrically conducting material, it may also

be a metallized member, or a member with one or more electric conductors provided on the member, where the electric connection is established to these one or more conductors.

The material 10 filling the different cavities may be different and have different characteristics. As an example, the material filling one of the cavities may be transparent and may serve as a light conductor for conducting light from a light source to a remote destination. The cavity or bore defined within an inner tubular member can be unobstructed. In this case the bore may be used as a pipeline for directing a gas or liquid flow through a structure built by means of a set of interconnected structural elements. Also, cavities defined between members may be only partially filled so as to provide a duct or a channel along the extent of the element.

Such structural elements can be adapted to conduct e.g. power, information and/or gas or liquid, and forming a connection involves forming connections between pairs of members or (filled) cavities in two or more elements.

The elements 6 in Figures 1A-C have several functions including suspension purposes and conduction of several signals and/or materials. The element comprises several members 9 and several material filled cavities 10. The members and the cavities may be constituted by and filled with different materials at different depths, as seen in e.g. Figure 1A. In the cross section in shown in Figure 1A, the core section 12 of the element comprises a solid element such as an electric conductor or an optical fibre. In the cross section shown in Figure 1B, the core section 13 of the element comprises a tube for conduction of gas or fluids.

Two or more trenches formed along the full extent of an element may divide members into separate conductive members; this is illustrated in Figure 2A. The trenches 13 may be filled with insulating material 14. Such pie-cut elements may be formed by sawing or milling narrow trenches 13, extending all or part of the way to the centre of the element, and filling these with the electrically insulating material 14. Thus, the capacity of an element can be multiplied by converting it into a pie-cut element. Most of the aspects relating to connections according to the present invention may just as well be applied to pie-cut elements.

In an another embodiment, an element equivalent to the pie-cut element of Fig 2A, a member 9 holds a layer 201 of conducting material on its outer surface (not shown) or layers 201 and 202 of conducting material on both its inner and outer surface, Figure 2B. By removing the conducting material in strips 203, separate electrical conductors 204 is formed on the outer and/or inner surface of the member 9, as shown in Figures 2C-E, corresponding to a bundle of wires. The strips 203 can be formed by cutting in the conducting layers 201 and 202 using e.g. laser cutting or mechanical cutting. In a preferred method of fabrication, two or more cutting heads (laser or mechanical) are arranged on a tool surrounding the element. By drawing the member through the tool, two or more conductors are formed in the surface of the member.

If one or more cutting heads are arranged on the tool, and if the tool or the member rotates around the center axis of the member, the strips 203 forms one or more spirals as shown in Figures 2D and E. Spiral-shaped conductors 204 have several functions:

- First, it allows any one conductor to be accessed from any off-axis direction simply by choosing the correct position along the axis.
- Second, length of the spiral shaped conductors 204 corresponding to the axial length of the member is determined by the pitch of the spiral shape. The length of a spiral shaped conductor 204 can be made very long whereby the end-to-end electrical resistance can be adjusted. Thus, spiral shaped conductors 204 can be used as a resistor in a circuit held by the member 9. Also, if one of the contacting point to the spiral shaped conductor 204 can be translated along the length of the member, a spiral shaped conductor 204 can be used as a potentiometer in a circuit held by the member 9.
- Third, since a spiral shaped conductor 204 corresponds to a wire coiled up on a member, a spiral shaped conductor 204 can be used as a coil introducing an inductance in a circuit held by the member 9. If the member holds two or more spiral shaped conductors 204, the inductance of the coil can be varied by connecting a variable number of conductors to the circuit.
- Fourth, the coil formed by a spiral shaped conductor 204 forms a magnetic field inside the member having a strength depending on the current in the conductor, the length of the member section holding the spiral shaped conductor 204, and the pitch of the spiral. Having the member in an element with a core member of a ferro-magnetic material will form an electro-magnet member. If the electro-magnet member has many

coaxial members holding spiral shaped conductor 204, the member can produce very strong magnetic fields.

In the following, some preferred materials for production of elements are given. Some of these are for the production of elements having special characteristics such as flexible elements (61 in Figures 11 and 12) and flat elements (110 in Figures 25 and 26) having a network of ducts. Materials used for the members and for separation of members can be chosen from many types of materials, preferably having the qualities described below:

Members: Any material that can be made into a substantially or partly tubular shape if supported, preferably any stiff and hard material, preferably electrically conducting, however also soft conducting materials such as metal grids and equivalents. In an element, some members may consist of materials not having any of the above qualities, but which may still be used together with members, that have. Moreover, only parts of a member need to posses the above qualities. Possible member materials can be these listed below, and any combination or alloy of these: metals such as Fe, Al, Au, Ag, Cu, Ti, V, Cr, Mn, Co, Ni, Ge, As, Sn, Cd, Pd, Mo, Ir, Pt, steel, stainless steel of any composition, brass, Semiconducting materials, Silicon, doped Silicon, silica, doped silica, plastic such as: thermosetting plastics, class fibre, Carbon, carbon fibre, ceramics.

Separating material: Any material which can at least partly fill up a cavity, preferably electrically insulating materials, preferably materials having a dielectric constant ε smaller than 10 such as smaller than 5, such as smaller than 3, 1.5 or 1.2. For example, any of the following materials can be used, as well as any combination or alloy of these: Semiconducting materials, Silicon, doped Silicon, silica, doped silica, plastics such as: thermosetting plastics, Macromelt (Henkel), class fibre, Carbon, carbon fibre, ceramics, silicone, rubbers etc.

The elements described above are preferably adapted to be connected into a system of elements. Since the members constituting an element are arranged inside each other, forming a connection to a selected member may affect members enclosing the selected member. The connections can be formed by geometrical shaping of a connection portion of the element. These portions can be shaped so those only members to be connected

are exposed in a manner suitable for establishing contact. Thereby it is possible to establish connections to selected members only.

The geometrical shaping of connection portions will typically be either protruding as in a male connector, or indenting as in a female connector. Female connection sites and male connection parts will be the general terms for denoting these shapes, however, the terms female site and male part will also be used, implying the same content.

Female connection sites can be formed by forming a recess or bore so as to expose contact surfaces of each of the one or more members to be connected. Preferably, the recess or bore is continuously or stepwise inwardly tapered. A recess formed in the end part of an element will typically extend parallel to the longitudinal axis of the element. Recesses formed in the middle section of an element will typically extend at least substantially perpendicular to the longitudinal axis of the element, preferably radially towards the axis.

Removing parts from the side of the element can form female connection sites in the form of bores 11 in Figure 1C, providing access to members 9 or filled cavities 10 in the element. Thereby contact surfaces of the members 9 and filled cavities 10 are exposed. The bore 11 can be shaped in any way so as to correspond to a male connection part 7b in Figure 1A and 8b in Figure 1B. Alternatively, the female site can be formed as a trench. Such trench may extend along part of or the whole longitudinal axis of the element. Again, the male part is formed in a shape complimentary to that of the recess of the female site.

In general, the recess of the female connection site may take any size and shape, and extend along any direction, the word recess should be interpreted to cover all shapes, also shapes otherwise covered by words like pit, hole, aperture, hollow, cavity, indent(ation), groove, trench, slit, etc. The principle of forming connections is simply to expose selected surface parts within the element so as to permit a connection to any or all of those members and/or (filled) cavities.

Forming a male connection part is in principle to provide one or more outer contact surfaces. This comprises forming a part into a shape complementary to that of a recess or bore so as to expose contact surfaces of each of the one or more members to be connected. Preferably, the part is an end part of an element similar to the element holding

the female connection site. Alternatively, the element holding the male part may be any type of element and the part holding the male part may be formed so that only some parts abut exposed surface parts of the female site.

Often, when the female connection site is a trench, the male connection part will be adapted to move in the direction of the trench. Alternatively, the trench may be at least partly filled with material so as to provide connection to selected members along the surface of the element. The outward surface may then form a rail along the element.

If the element has suspending purposes, the connection between male part and female site may provide suspension. In Figure 1A the element 7 is held in relation to the element 6 by the connection.

Female connection sites or male connection parts can be formed either during fabrication and preparation of the element or on location after the elements have been implemented in a system.

In order to ensure that the all connections are connecting the intended members of a first element correctly to the intended members of a second element, all connection may be formed using special shaped drills adapted to reach predetermined a depth. These drills are designed to form a female connection site in an element, which exposes contact surfaces of specific members or (filled) cavities only. Any specific combination of members can be coded into the shape, which is designed to enable connections only to those specific members. Also, specific types of elements or appliances can be adapted to connect only to specific members in any element. By using such drills, it is possible to configure large systems of elements so that different subsystems only connect to specific members in a main element type. An embodiment of such a system is shown in Figure 1B. The shape and depth of each individually shaped bore acts as a key for accessing the specific members according to the shape and penetration depth of the drill. The individual tapered shapes and depths will hereinafter be denoted as "keys". The shape does not relate so much to the overall shape of the female and male part, but more to the specific pair of members, which connects when joining female site and male parts of specific shapes.

If e.g. different specifically shaped keys are assigned to different types of structural elements or appliances, each structural elements or appliance only has access to the members according to the shape and depth of its key. Some or all structural elements and/or appliances may share some members whereas others may be accessible to individual structural elements or appliances only. Employing a pie-cut element as described previously may multiply the capacity of the main element in such systems.

As an example, all members in an element may be electrically conducting and separated by transparent material and the innermost tubular member can be hollow to allow for conduction of a fluid. Thereby, the element can

- transmit a plurality of electric and optical signals,
- provide power, light and water to a site,
- perform as structural element used for building purposes.

Utilising connections between elements, electric/optical signals, power, light and water may be conducted throughout a building, without additional use of materials than the structural elements used as a building structure.

In a first embodiment, shown in Figure 3A-C, a structural element 6 consists of tubular members 16 through 19 and a protective layer 20. The members 16 through 19 are made of an electrically insulating material, and have electric circuits formed on their outer surfaces. The first embodiment is a general example of some possible elements and the description of the first embodiment is therefore a general description of some of the possible electric circuits held by the members of the element. Elements according to the first embodiment can function individually or be adapted to form part of a system of interconnected elements.

The network of conductors forming a basis for most electric circuits are known from e.g. printed circuit boards or semiconductor substrates. Printed circuit boards are typically an insulating board or material layer with conductors laminated on. The conductors may be formed by a photo-chemical etching process or electrode-deposition. The circuit components can be inserted into pre-drilled holes and fastened by hand, machine or dip soldering.

Semiconductor substrates typically hold conductors and components forming integrated circuits. Integrated circuits are electronic circuits on a smaller scale than printed circuits,

some of the components typically held by a printed circuit are integrated circuits or chips. An integrated circuit is a piece of silicon or other semiconductor material on which is etched or imprinted a network of electronic components such as resistors, capacitors, transistors, diodes etc. and their interconnecting conductors. The conductors and components are typically formed by photolithography techniques.

When an elongated tubular member forms the basis of an electric circuit, the circuit can be formed using most standard techniques for forming integrated or printed circuits such as photolithography techniques and photo chemical techniques. Optionally, the member can be a tubular printed circuit board such as an FR4 board or an alumina board, or the board can be made of a flexible material, such as a flex-board, and adhered to the member where components are mounted.

Preferably, the members are first metallized by covering or impregnating the outer surface with a metal alloy or another conductive material. This can be done by immersing the member in the melted conductive material, whereby the inner surface of the member is also metallized, if accessible. Figure 5 shows such metallized members 24 where the conducting material layers 26 are visible in the enlarged details A and B.

The outer surface of a metallized member can be used as conductor or as a basis for forming the conductor network of a circuit. Writing the pattern of conductors, as well as some simple components, in the metallized surface can form a conductor network. The writing can be carried out by laser-beam machining where conducting material is evaporated by a high intensity focus of a laser beam, or by photolithography techniques where a photoresist and a phasemask is used to define areas of the metallized surface to be removed in a subsequent etching.

Alternatively, the conductor network, as well as some simple components, can be formed on a semiconducting member by photolithography techniques. Also, the pattern of conductors, as well as some simple components, can be formed in the outer surface of the semiconductor member by ion implant.

Components to be held by the outer surface of a member, whether integrated or printed circuit, can be attached in several ways such as by:

- Soldering or adhering conductors of the component to conductors of the conducting network. The components are preferably surface mount devices, which can be soldering or mounted by conducting adhesives on the outer surface of the member.
- Adhering bare dies with conductive adhesives such as silver filled epoxies and subsequent bonding to connectors on the bare die.
- Flip-chip mounting bare dies using solder or conductive adhesives, preferably anisotropic conductive adhesives.

Some preferred types of electric circuits held by the members 16 through 19 in Figure 3 are described below.

The outer surface of the innermost member 16 can form the semiconductor wafer base for an integrated circuit. Hence the member can hold a very large-scale integration (VLSI) of transistors and other components so as to form microcircuits such as one or more microprocessors for a Central Processing Unit (CPU) or store locations for a memory such as different types of RAM (Random Access Memory), EEPROM (Electronically Erasable Programmable Read Only Memory) etc. The element 16 thereby forms integrated circuits forming one or more parts of a computer.

The outer surface of member 17 can form the printed circuit board carrying a printed circuit. A pattern of conductors can be formed on the surface for connecting various electric components such as diodes, transistors or integrated circuits fastened to the printed circuit board. The element 17 thereby holds a printed circuit with components which can form the basis of any electronic device, e.g. a motherboard for a computer, a signal amplifier for telephone, TV, VCR, audio equipment etc., control unit for home automation systems such as lighting- or temperature control.

Semiconductor based electronic and optical components can be formed on or in the outer surface of member 18. For example, the member can form part of an optically integrated circuit, which receives optical signals from the transparent material filling the gap between members. Alternatively, semiconductor based micro-technology such as microphones, analysis systems, sensors, transducers etc. can be formed in or on the member 18.

The outermost member 19 is shown close-up in Figure 4. The outer surface of the member 19 holds an extensive printed circuit with distributed compact components 22

fastened to the member, e.g. by gluing or soldering, and connected through conductive lines 23. The member 19 can e.g. hold distributed processors where each component or processor performs a function at its location. Such components may be e.g. amplifiers, switches, multiplexers, chips, input devices such as sensors, keyboards or contacts, output devices such as a power switch, or distributed processors for controlling various plug-ins to the system.

In order to shield the members from each other and thereby reduce noise and stray capacitance, the inner surface 21 of each member is preferably coated with an electrically conducting material. This coating can also be utilised as a normal wire conductor.

Thereby the members and the conductors and components held by the members can be cooled to give an optimal performance. If the conductors and/or components are properly chosen and if the fluid is very cold such as liquid nitrogen, the conductors and circuits can become superconducting. The cooling of circuits held by one or more members of an element, have several advantages over cooling of circuits held on normal flat, open circuit boards. The ducts or cavities inside and between members holding the circuits to be cooled provide a sealed, safe and easy to use system for conducting a coolant. Maintaining a flow of coolant ensures a homogeneous cooling of the member and thereby of the circuit held by the member. The material separating the members may be chosen as a good heat conductor. The coolant can be conducted in channels formed between the members and/or conducted inside the pipe formed by the innermost member.

By providing superconducting circuits, very efficient conductors can be formed over large distances by having pure conductive members. Also, very fast integrated circuits can be formed, e.g. for use in supercomputers.

The element 6 of Figure 3 can have further members for transmitting signals to and from, and supplying power to, the circuits held on members 16 through 19. Some members may simply run through the element 6 in order to conduct signals or power to other elements connected to the element 6. Optionally, a part 5 of the element may be pie-cut in order to provide a plurality of transmission channels to each member.

As described in relation to the first embodiment, each member or structural element can form a separate part of a computer. In a second embodiment, a personal computer is

formed by several individual structural elements as shown in Figure 6. Structural elements 25 hold a motherboard with a CPU, a number of female connection sites 27 and a number of elements each performing a function for the computer. As examples, the element 29 holds a first hard disk drive, and the element 30 holds any RAM or ROM storage such as EDRAM, DRAM, SRAM, EEPROM etc. A monitor 33 is supported by and linked to the elements 25. The monitor 33 preferably comprises any interface to the motherboard, that is, it preferably holds any graphic driver, screen card, video RAM etc. used for the desired graphical performance. Different parts of the computer are separate parts connected by designated male/female connection parts, which ensures that members of a first element can only be connected to the designated members in a second element. Thereby the assembling of a PC as outlined above is straightforward as long as the user has the necessary parts available.

The keyboard 28 is formed by three elements, 32, 34 and 35 connected by a flexible element and also has a touchpad 36. Figure 7 shows two alternative embodiments of a keyboard 28. The keyboard 28 of Figure 7A comprises two keyboard elements 37 and 38 and a touchpad 36. The keyboard elements 37 and 38 are designed to be held in the hands of the user and may be assembled in a pivot joint 39. The keyboard elements communicate with the motherboard elements 25 through either a cord or a wireless link such as a link using electromagnetic waves such as infrared, RF or other.

Figure 7B shows a keyboard 28 comprising a plurality of elements 40 each comprising a key 41, which is assembled to form a keyboard. In normal keyboards, each key is a contact, which closes a circuit when actuated, the actuation is registered centrally by registering the current in the circuit. In the keyboard 28 of Figure 7B, each element registers the actuation of its key 41, e.g. by a microprocessor held by the element, and sends a specific signal on a conductive member common to some or all elements 40. Alternatively the element sends a signal on a designated conductive member when the key is actuated. Preferably, all signal from elements 40 are registered in the main keyboard element 42 which generates a data string comprising the typed information. By assembling the elements 40 in different order and formation, the overall set-up of the keyboard can be customised. Thus, the keyboard can be adjusted for ergonomic purposes. Also, the keyboard type may be changed from e.g. a QWERTY keyboard to a Dvorak or other type of keyboard. Further, the keyboard can easily be adapted to different languages having different signs and number of signs. Also a keyboard can be easily

constructed for special uses where custom keys or set-ups are desired. The keyboard shown in Figure 6 is preferably also build by elements 40 and hence provides the same functionality as described in relation to the keyboard of Figure 7B.

It is very easy for the user to add various hardware to his computer. More RAM or a further or larger hard drive can be added simply by inserting a RAM element 30 or hard drive element 29 in one of the vacant female sites 27 in the motherboard elements 25. A network connection can be established by inserting an element holding a modem, network driver, antenna or cable. Speaker elements 44 and a camera element 45 may be inserted in a motherboard element 25. A microphone element 46 also comprises an amplifier and is preferably positioned in the vicinity of the user. The speaker elements 44 preferably comprise their own amplifiers and the camera element 45 holds its own drivers optionally its own memory for storage of recorded pictures.

All the described elements are preferably powered by one power source such as a power outlet (not shown) or a battery element 47 connected to a motherboard element 25. A designated member in a specific depth in all elements is accessible in all female connection sites by all male connection parts. This provides an easy accessible power supply to all elements throughout the computer. Alternatively, some elements such as one or more of the keyboard elements 32, 34 and 35 may have battery elements inserted, which can also supply power to the touchpad 36.

It is an important aspect of the elements according to the present invention that they are not restricted to be used in relation to one appliance only. Since each element provides connection, function and structure, each element can be used individually wherever its function is needed or desired. Thereby, the monitor 33 could be used as a TV or surveillance monitor if supported by another element, the speaker elements 44 can be inserted in any radio or audio element since they themselves comprises amplifiers, another keyboard 28 may be connected in order to allow for several simultaneous users of the same computer.

In a third embodiment, the functionality of the system is extended to an automation system providing control, functionality and structure to a network of elements such as in a home, hotel, conference centre, hospital, school, an airport, an institution, a laboratory, a production plant, a stage such as for concert halls or theatres etc.

In Figure 8, a network 50 of structural elements according to the third embodiment is constructed together with a building. The network 50 provides different parts of the building with electricity, hot/cold water, gas, communication lines etc. using only one network instead of separated networks of lines and pipes. In addition, the network 50 provides a plurality of vacant electric and optical conductors throughout the building. Cross sectional views of some preferred structural elements for use in the network 50 is the element 6 in Figure 1 or Figure 2. As is seen, different members and cavities at given depths and directions provides different properties.

Preferably, the network has one or more main elements 31 forming a substantially stationary part of the network. Further, the network preferably has a control section 52 with elements, which together provides a protocol for control of the different types of elements connected to the system. Such protocol is a set of operational procedures attending to the control, co-ordination and collaboration of the elements in the system. Preferably the control section comprise elements which together forms a computer such as a server or a (PC) Personal Computer. The elements shown are a motherboard element 25, hard drive elements 29 and RAM elements 30 as described in relation to Figure 6. The control section preferably also comprises modem elements etc. The control section can be accesses from anywhere in the system, e.g. by plugging a keyboard 28 into the system and/or using a monitor 33 anywhere in the system. Also, a workstation in the form of a PC can be connected anywhere in the system. It is an underlying principle of the system 50 in the third embodiment, that access to elements connected to the system can be achieved anywhere in the system, e.g. by utilising elements such as a keyboard and a monitor.

In order for the elements to form a network, the have to be interconnected in various couplings such as the T-piece 48 and the X-piece 49 in Figure 9.

In the following, a variety of different elements for performing one or more functions will be described in relation to the system in order to illustrate the overall functionality of a system and elements used in a system.

The functional elements are preferably adapted to form part of a system such as the system 50 of Figure 8, simply referred to as "the system" in the following. An element for

performing a function can be connected to the system in several ways; the element 54 of Figure 10 also performs as an intermediate link forming part of the system structure in that it connects the antenna 60 and the camera 45 to the system. The element 56 on the other hand forms a separate unit plugged into the system network, without any possibility of connecting further components to the element 56. Thus, each element can have one or more male or female connection sites. The elements 54 and 56 will typically be powered through a connection to a power mains member in the system. By use of the key-system, all members can connect to the same power mains member and individually to other members.

Optionally, the element 58 of Figure 10 forms part of the system through a wireless connection to the system, and therefore comprises a battery 59 and an antenna 50. The system and the element can support a one or two-way communication link for transferring signals carrying data and/or instructions such as commands. Alternatively, the element 58 is adapted to perform as an independent device, e.g. together with other functional elements connected thereto, without contact to the system.

Preferably, the battery 59 is a battery connected to the element 58 and adapted to be recharged by plugging the battery into a an element comprising electric power members, or into a charging station 53 plugged into the system 50 in Figure 8. The battery 59 is connected to the element 58 by connecting the male part of the battery 59 to a female connection site of the element 58. Batteries having different sizes, current supply levels, voltage supply levels, lifetime etc. can be provided. Different batteries may connect differently to different members of the element, and hence different functional components, according to the "key"-system described earlier.

Alternatively the battery is comprised in the element 58, and is recharged by plugging a male part of the element 58 directly into an element of the system 50 comprising electric power members or into a charging station 53.

The following specific elements can be adapted to perform according to the general element described in the above, that is to perform in the system either in direct or wireless connection to the system or as individual elements optionally in connection with other individual elements.

Figure 11 shows flexible elements 61 preferably having male and female connection sites at the ends. The section 62 of the element is flexible and can be bend, whereby the end parts 63 and 64 can be connected to elements extending in nonparallel directions. Figure 12 shows a close-up of a flexible element 61. The members forming the flexible section 62 are formed in flexible materials and separated by a soft material in order for the section to be flexible. Conducting members are preferably formed by a tubular metal wire mesh, a metal foil, a bundle of metal wires or any other flexible electrically conducting means. Naturally, the material separating the members is compressible and flexible. Alternatively, the flexible section of the element does not have the "concentric tubes" construction as a typical element, but is merely constructed so as to connect pairs of members of the end parts 63 and 64.

In a first embodiment, the flexible element 62 of Figure 11 can be manually bend. The flexible section preferably has a firmness so as to hold a position when forced into the position e.g. by hand. Thereby a flexible element can be bend into, and held in, any desired position.

In a second embodiment of the flexible element 61, the flexible section 62 comprises electric powered means for bending the element. These means are preferably muscle wire encircling the flexible section. In the second embodiment of the flexible element 61, one or both of the end parts 63 and 64 comprises a control circuit such as a microprocessor or a hard-wired control circuit for controlling the motion of the flexible section 62. Preferably, the control circuit can receive and execute instructions related to the motion of the flexible section, thereby the motion can be remotely controlled. The instruction can be comprised in analogue or digital signals transmitted to the flexible element by members of the system. Optionally, the flexible element according to the second embodiment can also be bend manually similar to the first embodiment of the flexible element.

Flexible elements are preferably utilised for connecting other elements to the system whereby the movement of the other element can be controlled. This is illustrated in Figure 8.

Connections between element can be movable links or joints such as hinged, rotatable, flexible, elastic or displaceable connections between elements. Such a hinged and

rotatable connection 67 is shown in Figure 13, and the elements 65 and 66 can be moved according to the arrows. Preferably, the connection 67 has a firmness so as to hold a position when forced into the position e.g. by hand. Optionally, the movable connection 67 comprises electric circuitry in the form of one or more sensors connected to a processor adapted to determine and preferably report the position or the movement of the connection 67. There by the movable connection 67 performs as a mechanical sensor.

A functional element in the form of a light-source element 68 is shown in Figure 14. The end part of the element 68 holds a reflector 69, a light bulb, LED, or other light emitter 70, and preferably a protection glass 71. One or more members of the element conducts power to the light bulb and also provides an actuator contact 72 so that the user can turn the light on/off. Optionally the element 68 also holds electric circuits and components for performing functions such as adjusting the intensity of the light, the light-cone, the colour of the light, predetermined modulation cycles such as stroboscopic light etc. and contacts for controlling such functions.

The light-source element 68 can function either as a stationary lamp or spotlight at given position in a system 50 as shown in Figure 8, or as a flashlight with a battery power supply. The term stationary is only intended to mean stationary contrary to a flashlight adapted to function while carried around, in fact, the underlying idea of the stationary lamp as described in the following, is that is can easily be connected anywhere in the system 50 of Figure 8.

In the case of a stationary lamp, the lamp is supplied by a power mains member of the system 50. The lamp can be plugged into any branch of the system and function immediately. Optionally, the lamp can be connected to the system through a flexible element 61 as shown in Figure 8, in order to provide adjustment of the lamp. Also, the operation of the lamp, e.g. the intensity, colour etc., and the flexible element can be remote controlled and form part of a home automation system, stage lighting system, conference centre lighting system, etc. Optionally, the lamp is connected to the system through a power management element, which provides appropriate voltage/current to the lamp.

In the case of a flashlight, a battery 59 is connected to the light source element 68 by connecting the female connection site of the battery 59 to the male part at the end part of

the element 68. The battery 59 also provides structure in that it forms part of the grip of the flashlight.

The light emitter 70 of element 68 in Figure 14 may also be small and powerful in order for the element 68 to function as a working light for instruments operating at localities not easy accessible, such as dentist instruments for working in the oral cavity or surgical instrument. Such small and powerful light emitter can be an array of LED's positioned so as to focus the light. Such working light is advantageously combined with the second embodiment of the flexible element 61 which can be bend electrically. Powerful light emitters tend to generate a lot of heat, and the small element will eventually heat up. In order to reduce the heating of the element, it can either be cooled or it can comprise a thermal conductor for conducting away the excessive thermal energy. Cooling of elements by fluids has been described in relation to Figures 1B and 4. The light emitting element may have a thermal conductor in the form of a heat conducting tubular or core member. The heat-conducting element can be gradually expanded leading away from the light-emitting element 68 in order to enlarge its heat capacity and surface area and thereby reduce the temperature. Since good thermal conductors are typically also electrical conductors, the thermal conductor should be properly isolate from the circuitry controlling the light emitter 70. Alternatively, the thermal conductor can serve as the electrical connection to the power supply to the light-emitting element. Keeping the temperature low is especially relevant for the dental and surgical applications where the temperature must be kept below ~ 50°C in order not to damage (burn) organic tissue.

Another functional element is a speaker 44 as shown in Figure 15. The speaker 44 can be plugged in a system 50, as shown in Figure 8, so as to provide a speaker outlet at any position in the system. The speaker can thereby, by use of the "key"-system, be connected members connected to different audio signal providers in the system 50, such as a TV, radio, stereo set, Personal Computer, baby surveillance etc. in a private home, a sound system or an information service and intercom in e.g. a shopping centre.

Preferably, the speaker element 44 holds one or more members holding an amplifier such as an analogue or digital signal amplifier. Another member then preferably holds an electric circuit for gain control of the amplifier, which can be controlled either by signals from the audio signal provider, signal from wireless remote control or actuator buttons on the element. Alternatively, the amplifier may be a separate element adapted to

interconnect the speaker to the audio signal providing member, whereby a variety of different amplifiers can be selected for different purposes.

An audio signal provider can be any element in the system normally having an audio output, such as components from a typical stereo set; radio tuner, record player, compact disk player, tape player, mini disc player, MP3 player, TV, Video tape recorder, DVD player, laserdisk player, personal computer, etc. Any such component may be adapted to be connected to a system 50, e.g. by being formed at least partly in or by a functional element according to the present embodiment of the invention. The audio signal provider provides the analogue or digital signal to a predetermined member within the system, and the speaker 44 can receive, amplify the signal and provide the sound at any given location within the system by forming a connection to the predetermined member.

If the audio signal provider is formed in or by a functional element according to the present embodiment, interconnecting a speaker 44, one or more audio signal providers and a battery 59 forms a portable stereo set such as a ghettoblaster. Also, assembling a RAM or EEPROM element 30, a battery and a speaker 44 provides a portable audio file player such as an MP3 player. Further, assembling a receiver, a speaker 44, a battery 59 and an antenna element 60 provides a portable radio such as the element 58 shown in Figure 10. The key system ensures formation of connections between appropriate members.

The functionality described in relation to the speaker, amplifier and audio signal providers directly translates to other components such as microphones, cameras, display devices.

Figure 16 illustrates functional elements 74 and 45 with members holding a camera with a lens 76. The camera records and provides the recorded signal to a predetermined member in the camera element and the signal can be displayed, processed, transmitted by a communication link, or stored by any video signal compatible device in the system. Preferably, one or more members in the camera element process and amplifies the signal so as to adapt the signal for transmission. The light sensor of the camera can be a digital light sensor such as a CCD or a CMOS based light sensor. If the light sensor is a digital light sensor, one or more members of the camera element may provide storage for storing the signal, and graphic driver, screen card, video RAM etc., in order to prepare the signal for showing on a display.

The camera element 74 is adapted to perform as an interconnecting element according to the general type element 54 of Figure 10, in that the camera lens 76 form part of the connection site. The camera element 45 is also shown in function in Figure 6 and Figure 8.

Similarly, Figure 17 shows a functional element 46 holding a microphone 78. The microphone 78 records and provides the recorded signal to a predetermined member in the element 46 and the signal can be played, processed, stored or transmitted by a communication link. Preferably, one or more members in the microphone element 46 process and amplify the signal so as to adapt the signal for transmission. The microphone 78 can record an analogue or a digital audio signal, and one or more members of the microphone element 46 may provide storage for storing the signal, and audio driver, sound card, audio RAM etc., in order to prepare the signal for use in digital devices such as in the computer of Figure 6.

The camera element 46 may also perform as an interconnecting element according to the general type element 54 of Figure 10, in that the microphone 78 can form part of the connection site.

In the system 50 shown in Figure 8, the a camera element 45 and a microphone element 46 form part of a surveillance system, where the visual recordings and the recorded sound can be provided anywhere in the system.

The monitor 33 described in relation to the computer of Figure 6 is preferably adapted to perform a number of other functions. The monitor (screen or display) 33 preferably functions as a general visual output device for a number of elements such as surveillance cameras, alarm systems, videophone, browsers, computers, TV set, video player, DVD player, thus as a message board and interface for all elements including the control section 52 of the system 50 in Figure 8.

The structural elements can also conduct a gas or a fluid, and an element utilising this property is a gas stove 79 shown in Figure 8. The network of elements provides gas to the stove and optionally electric power for electric ignition of the stove. It is preferable to provide surveillance sensors such as a thermometer, e.g. in connection with a thermostat,

in order to regulate the heating during cooking, or a molecular composition detector to detect gas leakage. These surveillance sensors will preferably be connected to the system whereby cooking can be remotely controlled or a gas leakage alarm sent out throughout the building.

The conducting of gas or fluid can also be used for e.g. water to a hot water radiator, a tap or sprinklers for fire fighting or for air in ventilation or air conditioning systems. Some of these applications are especially applicable in industry or institutions such as production plants, laboratories, hospitals, etc.

Other appliances which can advantageously be formed as elements according to the third embodiment. Some of these are briefly described here:

A battery element 59 is shown in Figure 18A and C, which have been mentioned in relation to the computer in Figure 6 and the general transportable element 58 in Figure 10. The battery element 59 can comprise one or more galvanic cells formed by two or more members 9 with electrolyte at least partly filling the cavities between these members. The members 9 should be electrically connected so as to form an anode/cathode for the battery. Prior art batteries have anodes/cathodes formed as metal sheets rolled of as square (or circular) spirals 130 as shown in Figure 18B. A disadvantage of prior art batteries is that the rolling up/spiralling of the metal sheets causes stress in the metal sheets and thereby reduces the lifetime of the batteries. The anodes/cathodes of the battery 59 of the present invention as shown in Figure 18A will not suffer from reduced lifetime due to stress. By coating and connecting the inner surface areas and outer surface areas of members 9 separately, the inner surface areas may form one large anode whereas outer surface areas form one large cathode.

Alternatively, as shown in Figure 18C, the element comprises a standard battery 80 with its terminals either accessible or connected to two or more members of the element 59. The battery preferably also provides a plurality of members 9 for connecting members of elements interconnected through the battery element 59.

Figure 14 shows a number of different light emitters 81 arranged on elements 82. The light emitters 81 can be given almost any shape, size and colour. The light emitters 81 are preferably LED's (Light Emitting Diodes) having different shapes, sizes and colours and

being provided with a variety of reflectors and light guides. The elements 82 preferably hold electric circuitry for providing power to the LED's and for controlling the operation of the LED's.

A thermometer 83 in Figure 19 comprises a heat sensor 85 and a display 84 for showing the temperature. The thermometer element 83 preferably holds circuitry for providing electric power from a member of the thermometer element connected to a power mains member. Also, the circuitry determine the temperature from the sensor reading, displays the temperature on the display and generates signals comprising the temperature to be transferred. Optionally, the Thermometer comprises a processor and storage for processing, transmitting and storing the temperature readings.

The antenna element 60 in Figure 19 optionally holds circuitry for making time divisional multiplexing of signals received on different members and transmit the multiplexed electromagnetic signal. Similarly, the circuitry can de-multiplex received electromagnetic signals and transmit different signals on different members.

The element 86 on Figure 19 comprises sensors 87 such as molecular composition sensors for determining gas composition, such as an artificial nose. Alternatively, the sensor can be adapted to determine properties such as humidity, such as a hygrometer, pressure luminosity etc. As for the thermometer element 83, the sensor element 86 preferably comprises a processor and storage for processing, transmitting and storing the sensor readings, and for receiving instruction related to the operation of the element.

The element 88 shown in Figure 19 is an adapter element for forming connections to elements, plugs, jacks, devices, appliances, etc. which does not have the concentric layered configuration of conductors according to the preferred elements. Hence a first connection portion of the adapter element connects to a preferred element and second connection portion provides a different geometrical shaping and configuration of exposed conductors 89.

Figure 20 shows three mechanical contact elements 90, 91 and 92. The contact element 90 comprises a push button contact 93 and preferably one or more electrical circuits. The button can break or close a circuit that is completely or partially within the contact element 90. Optionally, the element comprises mechanical sensors for registration of the force or

duration of the pushing down of the button. The contact element 91 comprises a contact 94 preferably connected to a rheostat which can stepwise or continuously adjust the resistance in a circuit completely or partially within the contact element 91. Optionally, the element comprises mechanical sensors for registration of e.g. the speed with which the contact is operated. Further, both contact elements 90 and 91 can comprise a microprocessor or equivalent for generating a digital signal related to actuation of the contact.

The contact element 92 in Figure 20 is a joystick element with a grip 95. The element 92 comprises mechanical sensors for determining the motion of the grip 95. The joystick element 92 comprises a microprocessor or equivalent for generating a digital signal comprising information related to the motion of the grip 95.

A number of functional elements have been described in the above. It is possible to divide most of these functional elements into three main classes, namely

- Output elements: Provides an output such as a command, an instruction, a message a signal such as a light signal, an audio signal, a visual signal, a mechanical signal, an electric signal etc. or electric power to an electric appliance connected thereto. Interface elements such as the control element described in relation to the lamp are also output elements.
- Input elements: Receives input such as a command, an instruction, a message a signal such as a light signal, an audio signal, a visual signal, a mechanical signal, an electric signal etc. The device can receive the input through a sensor, e.g. an electromagnetic radiation sensor, luminosity sensor, moisture sensor, movement sensor, temperature sensor, mechanical actuator contact, sound sensor, pressure sensor, electric signal sensor, smoke detector, audio pattern recognizing means, visual pattern recognizing means and molecular composition analyzing means, or an input unit such as a keyboard 28 connected thereto. Other devices in the system can be programmed to respond to a signal from a device receiving input.
- Devices performing a function such as a CD player, a computer, a battery charger, a gas cooker, a ventilation fan etc.

The distinction between these classes is not pronounced and the classification only serves as a means for extending the sphere of conceivable elements utilised in the system. The given functional elements are intended as examples, showing the multitude

of elements comprising electric circuitry, which can advantageously be worked out as elements according to the present invention. It is the intention of these examples and the classes to show that the combination of elements and the thereby achieved functionality are practically unlimited.

The system 50 described in relation to Figure 8 combines the electrical, optical and fluid conduction properties (the wiring, guiding and piping) of the elements with the functions provided by the electric circuits in elements into a plurality of parallel networks providing an increased functionality. The increased functionality is provided by the distributed capacity that arises from the fact that each element comprises the circuitry needed for it to perform its function. Thus the system is an implementing of the principle of distributed processors. Also, the circuitry makes an element capable of connecting to the network and extract the signals, power or substances needed for it to perform its function. Further, the elements are at the same time adapted to communicate or interact with one another; when making information from one element available on the network, the information will reside on the network ready to be extracted by another element, which due to its circuitry is not dependent upon other elements to extract, prepare and use the information.

In a fourth embodiment shown in Figure 21, elements 98 and 102 holds an electromotor 99. The electromotor 99 is any existing electromotor fitting inside the motor elements 98 and 102. The electromotor 99 has a shaft 100 for performing rotations at the centre of the element. The electromotor is powered by a conductive member connected to a power supply such as a battery or a power mains member in another element. The element preferably has one or more members holding electric circuits such as one or more microprocessors for controlling the performance of the electromotor 99. The control circuitry can e.g. be receive instructions by signals provided through a system 50 as described in relation to Figure 8 or through a wireless link. The shaft 100 can provide couplings 101 in one end as for the elements 98 or both ends as for the elements 102. The couplings 101 can be connected to shafts in other elements in order to transmit the rotation to elements connected to motor elements 98 or 102. Also, the shaft 100 can be coupled to a fixed member in an element connected to the motor elements 98 or 102 in order to rotate the connected element in relation to the motor element.

The fan 107 on Figure 8 is preferably mounted on and driven by a motor element according to the fifth embodiment.

Another example of utilising motor elements is shown in figure 22, where three interconnected elements 103, 104 and 105 is each connected to further elements 106. If one or more of the elements 103, 104 and 105 are motor elements 98 or 102 as described in relation to Figure 21, the elements 103, 104 and 105 can rotate in relation to each other around their common longitudinal axis. The assembly thereby providing a rotary coupler where the directions between members 106 connected thereto can be adjusted.

The system 50 described in relation to Figure 8 combines the electrical, optical and fluid conduction properties (the wiring, guiding and piping) of the elements with the functions provided by the electric circuits in elements into a plurality of parallel networks providing an increased functionality.

Elements according to the present invention can be produced to have a very high bending strength. This makes them especially applicable for supporting and suspension purposes, and an important application of the elements is to connect elements so as to create self-supporting structures. Such structures combine the high supporting strength of elements with the wiring, guiding and piping and the functions provided by the electric circuits into one simple, functional construction.

A fifth embodiment of the present invention is a network similar to the networks described in the third and fourth embodiment, but further providing self-supporting structures.

A first example of the fifth embodiment is shown in Figure 23, where a self-supporting structure 108 provides. The elements such as the monitor 33, keyboard 28, speakers 44, microphone 46, ventilator 107 and lamps 68, described previously in relation to the computer of Figure 6 and the system 50 of Figure 8, are here utilised differently in that they are assembled by the self-supporting structure 108 and thereby does not comprise motherboard elements 25 as such. Hence the self-supporting structure 108 comprises advantages over the network of the system 50 described in relation to Figure 8, in that it also provides the spatial construction of the network.

In a second example, the self-supporting structure is a flat element 110 in Figure 24. As can be seen from the female sites 27 or in Figure 25, the flat element 110 comprises a

plurality of preferably electrically conducting, flat members 112 separated by layers 113 of preferably compact, electrically insulating material. Optionally, the members are electrically insulating members that are either metallized or have one or more conductors provided on its surface. The flat element 110 of the second example holds further advantages in that it provides a continuous, spatial network construction combined with the properties of a flat element. The flat element 110 functions also as a wall in a building, furniture such as a tabletop or shelves, a monitor, screen or display, and hence provides the wiring, guiding, piping and the functions provided by the electric circuits anywhere in constructions and devices comprising flat elements 110. Alternatively, the flat element 110 can intentionally be made flexible. Thereby the flat element can be bend or shaped allowing for even more applications.

The tubular elements can be connected to the flat elements. If a tubular element is to be plugged into a flat element 110, a female connection site 27 is formed in the flat element with a special designed drill or equivalent. The connection sites and corresponding connection parts are preferably formed according to the key system described previously. When an element is removed, the female connection site can be stopped by a plug 111 as shown in Figure 24. A flat element can also be connected to a tubular element as Illustrated in Figure 25. Protruding male parts 114 are formed at the edge of the flat element 110, and contact surface 115 of the elements 112 are exposed on these male parts 114. By forming a plurality of male parts 114 and corresponding female parts 116 in a tubular element 6, a connection between members, or conductors provided at members, of the flat element 110 and the tubular element 6 can be formed. Due to the strength of tubular and flat elements, the connection provides substantial rigid construction.

In a third example, the flat elements 110 are produced with channels or ducts in the layers separating the members. Separating two members with a grid or foam having a continuous network of channels or ducts preferably produces these channels. Alternatively, the layer separating two members is cast while a template of the desired network separates the members. After the casting material has solidified, the template can be removed, leaving the desired ducts.

The ducts are preferably be used to conduct air or gas in a ventilation or air conditioning plant used to control the indoor climate. For that purpose, flat elements comprising a network of ducts can have perforations from one or both surfaces to the ducts for the air

to pass through. Such flat element preferably holds electric circuitry for e.g. climate control, such as thermometers and hygrometers as well as means for guiding the airflow through the network. Alternatively, these functions are provided by functional elements plugged into the flat element 110.

The partly hollow flat elements also provide the function of cavity wall insulation due to the small thermal conductivity of the ducts.

In a fourth example illustrated in Figure 26, the flat elements 110 are used to construct a house or a building together with tubular elements 117. The flat and the tubular elements are connected as described in relation to Figure 25. The tubular elements 117 are preferably of a very strong construction. The members can e.g. be tubular metal grids and the element is cast in plain concrete so as to form a member, which is essentially reinforced concrete. The self-supporting network structure formed by the flat and tubular element provides the same function as the main element 31 in the system 50 described in relation to Figure 8. Moreover, the flat and tubular elements can comprise electrical circuits forming devices such as sensors for controlling the indoor climate and the condition of the elements.

Figure 27 shows another version of the self-supporting network structure of the fourth example. Here, the tubular elements form through-going pillars throughout the building. The pillars provide connection sites 118. Figure 28 shows a close up view of a pillar 117 with some functional elements plugged into the pillar.

In a sixth embodiment, the functionality described in relation to the system 50 of Figure 8, applies to a system composed by a network of structural elements in an automatic machine such as a car or any other vehicle, train, plane, boat, space shuttle, space station, space probe, satellite, submarine or a robot, a tool, toy, production plant machine or other machines.

The assembly of an automatic machine completely or partially composed by a network of elements is very simple in that the network can apply to all individual portions or components of the machine. The electrical system of such a machine will have a minimum of wires and distributed processors can advantageously be utilised. Furthermore, since the elements can be combined into a strong construction, the machine can be

build in the types of elements described in the various embodiments. By utilising the flexible elements 61 and motor elements of the fourth embodiment, the elements can also supply movable parts of the machine.

The machine is preferably powered by a power supply such as solar cells, a generator connected to a turbine or equivalent, any electrochemical process, any combustion process, a nuclear reactions etc. Preferably, the element holds a battery, which can then be recharged either at a charging station or by any of the power supply methods given above.

The described elements comprise rigid or flexible tubular elements and rigid or flexible flat elements in various shapes and sizes. However, different types of element utilising the principle of combining the electric circuits with the high supporting strength and the wiring, guiding and piping properties of a layered structure, can be produced. Such other types of elements are comprised in the underlying idea of the present invention. The complete electrical system of the machine or robot can be controlled by a power management system such as a system according to WO 98/45923 by Reipur.

The machine or robot can be a self-contained machine operating on its own with no direct human interaction. The machine or robot can for example be a submarine for operating in large lakes and oceans for collecting environmental data, surveillance, or collecting nature resources such as energy, minerals, plants, micro-organisms etc. Equivalently, the machine or robot can be a space satellite. Such a submarine or satellite must be able to handle a large number of functions, such as:

- keep track of its movement and be able to seek a predetermined position,
- seek shallow waters a regular intervals in order to establish a communication link with a central computer by a satellite connection,
- performing maintenance and reparations on itself, or re-organize its parts if a section is damaged. This can be done since any element comprises a large number of members and hence by drilling in an element, another element can be connected to any member in the element,
- extending itself by adding new functions as they become necessary or it is instructed to do so,

- the power management system controlling the electrical system can detect errors and damages in the system as well as extensions and re-organised elements and redirect or cut off electric signals accordingly,
- etc.

In a submarine according to this example, the elements can be produced under pressure in order to be able to sustain pressure on large depths. If the members consist primarily of uncompressible materials, this may not be a requirement.

In a seventh embodiment, the different types of elements are used in toys. Preferably, each element is an individual unit and for a set of elements there will be many possible combinations.

A first example of the seventh embodiment is shown in Figure 29. Figure 29 illustrates the upper body 120 of a person. The torso 121, the neck 122 and the head 123 are three interconnected elements. In the specific example, the torso 121 is a motor element such as the elements 98 or 102 described in relation to Figure 21. The person is provided with senses in the form of functional elements, namely; a mouth in the form of a speaker element 44, a nose in the form of a molecular composition sensor element 86, eyes in the form of camera elements 45, ears in the form of microphone element 46 and a feeling for heat and temperature in the form of a thermometer element 83. Preferably, all these elements each comprise the necessary circuitry such as signal amplifiers, transmitters, receivers, drivers, RAM etc. for it to function.

By providing the head element with a processor and data storage, the head may be able to react in response to the interaction with its surrounding, e.g. a child. Due to the extensive number of inputs in the form of the senses, the person 120 can display a very complicated pattern of reaction. Alternatively, the person 120 is provided with artificial intelligence e.g. in the form of neural networks. The person 120 will then be capable of learning from and playing intelligent games with the child.

If the position of any of the elements such as any of the senses is switched around, the person will preferably act differently. If e.g. a camera element 44 and a microphone element 46 are switched, the person 118 may ask the child to switch them back, tell a tale

related to eyes or ears, start complaining about pains in the eye or ear, ask the child which senses it have changed, etc.

In another example, a toy comprises a set of elements, all with a number of male and female connection portions (not shown). All elements are adapted to me connected to each other, and some elements being functional elements such as a speaker element 44, a camera elements 45, a flexible element 61, a microphone element 46, a motor element 98 or 102, a light emitting element 82 or a battery element 59. Optionally, all elements comprise their own battery.

If two specific element are assembled in a given configuration, the assembly will either perform a function such as move, provide an output such as a sound or a light, or give a response in the form of an output in response to visual or audio inputs. However, if the same two elements are assembled differently, the function, output or response will change. Also if a third or further elements are added to the assembly the function, output or response will change again, and if one of the first two are removed the function, output or response also changes. In that way, the set of elements provides a large number of combinations where each unique assembly preferably provides a unique function, output or response.

In the second example of the seventh preferred embodiment, the toy has at least a microphone element 46 and a speaker element 44, a battery element 59, and an element 30 holding a processor and memory, as described in relation to e.g. the computer shown in Figure 6. When the element are combined in a specific way, they will record any sound made while combined in that way. When the elements have been dissembled and combined in the same specific way again, it will play the recorded sound. Thus, when dissembled and combined a few times, the toy will play different sound when combined in different ways.

In a third example, an apparatus or a machine can be build from a set of elements. The child can e.g. build a fire truck where water is transported through the structural elements from a reservoir to a fire hose, and wherein a siren may be comprised in one connecting element, light is provided at a the roof of the fire truck, and where e.g. the ladder of the truck is movable.

The truck may be controlled by a single processor provided at one connecting element, the processor transmitting controlling signals to functional elements such as actuators, light generators, and other controllable parts via the structural elements, and the processor responding to data from e.g. a camera or microphone element. Also, naturally, the fire truck may comprise any number of processors communicating via the structural elements for e.g. controlling different parts of the fire truck or for e.g. handling communication between the fire truck and a remote control handled by the child. Using low voltage applications children can easily build up even complicated structures including wiring and piping. The third example is a small-scale kit of the machines according to the sixth embodiment.

In a further embodiment, the elements according to the present invention are combined to make a tool having multiple functionalites. Two examples of such tools used as dentist tools are shown in Figure 30. Each tool has a main element 139 attached to arms formed by elements 6 and joint 67.

The first tool has a duct in a hollow core element connected to a compressor and an opening 142 for blowing air to the tooth. Also, a camera 45 is arranged in the main 139 for recording the operation e.g. for display on a monitor so that the dentist can follow the operation. The main further comprises a plurality of LEDs 70 arranged in an array for focusing the light onto the tooth providing light to the camera. The camera 45 and the LEDs 70 are connected to circuitry held by elements 129 and 6. The circuitry connected to the camera in the main element 139 comprises digital processors and memory for controlling the operation of the camera and storing the recordings. Thereby, the main element 139 is a self-contained tool which only needs to be connected to a station providing compressed air and electric power.

The second tool held by the main element comprises an electro-motor element 98 driving a drill 140. The main element also has a nozzle 141 for making a water spray to clean away the chips cut loose by the drill 140. The nozzle is connected to a duct in the elements 6 which are again connected to a supply of water. Further, the main element 139 can comprise an extra LED 70. Again, circuitry in the main element 139 comprises digital processors for controlling the operation of drill and water nozzle so that the main element 139 is a self-contained tool which only needs to be connected to a station providing water and electric power.

CLAIMS

1. An element for holding one or more electric circuits, the element comprising:

an elongated tubular, electrically insulating first member having a longitudinal axis and an outer surface area, and

an elongated tubular, second member having a longitudinal axis and an outer surface area,

wherein the first and the second member co-extend co-axially, one arranged at least partly within and radially spaced from the other, and

wherein the element further comprises one or more electric circuits comprising one or more electric components and one or more electric conductors connected to the one or more components, the conductors being provided at the outer surface area of the first member.

2. An element according to claim 1, wherein the first and the second member are at least substantially fixed in relation to each other.

3. An element according to claim 1 or 2, further comprising

at least one cavity defined between an inner surface of the outer member and the outer surface area of the inner member, and

a compact mass of material filling at least part of said cavity.

4. An element according to any of the preceding clams, wherein an inner surface area of the first member comprises one or more electrically conducting layers.

5. An element according to any of the preceding clams, wherein the second member is electrically insulating.

6. An element according to any of the preceding claims, wherein an inner surface area of the second member comprises one or more electrically conducting layers.

7. An element according to any of the preceding claims, wherein the element further comprises one or more electric circuits comprising one or more electric components and one or more electric conductors connected to the one or more components, the conductors being provided at the outer surface area of the second member.

8. An element according to any of the preceding claims, wherein the outer surfaces of the first and/or second members comprise one or more electric conductors being formed by conducting material deposited thereon.

9. An element according to any of the preceding claims, wherein the conductors provided on the outer surface area of the first member comprises one or more layers of conducting material covering at least part of the outer surface area, said one or more layers having a thickness in the interval 1-120μm.

10. An element according to claim 9, wherein said one or more layers having a thickness in the interval 18-105μm or 35-70μm.

11. An element according to any of the preceding claims, wherein the outer surfaces of the first and/or second members comprise one or more electric conductors being formed by ion implantation therein.

12. An element according to any of the preceding claims, wherein one or more electric components positioned on the outer surface of the first and/or second member are surface mount devices fastened using solder or conductive adhesives.

13. An element according to any of the preceding claims, wherein one or more electric components positioned on the outer surface of the first and/or second member are fastened using flip chip technology and anisotropic conducting adhesives.

14. An element according to any claims 6 to 13, wherein at least one conductor of the first member is electrically connected to a conductor of the second member.

15. An element according to any of the preceding claims, wherein one or more of the electric components comprised in the one or more circuits is any component chosen from the group consisting of resistors, capacitors, coils, diodes, transistors, integrated circuits, thyristors, inductors, switches, antennas and photonic components.

16. An element according to any of the preceding claims, wherein one or more of the electric circuits are any circuits chosen from the group consisting of operational amplifiers, microprocessors, processor, electric storage, magnetic storage, RAM, ROM, EEPROM, neural networks, power supplies, receivers, transmitters.

17. An element according to any of the preceding claims, further comprising an electric power supply adapted to supply electric power to at least one of the one or more electric circuits.

18. An element according to any of the preceding claims, further comprising at least one duct inside the first member, said duct being adapted to conduct a coolant for cooling at least one of the one or more electric circuits.

19. an element according to claim 18, further comprising one or more electric conductors adapted to be superconducting when cooled by the coolant.

20. An element according to any of the preceding claims, further comprising at least one end part comprising one or more exposed electric conductors connected to at least one of the one or more electric circuits of the element.

21. An element according to claim 20 wherein the end part is substantially concave, forming a female connection portion.

22. An element according to claim 20 wherein the end part is substantially convex, forming a male connection portion.

23. An element according to claim 1 to 5, wherein the second member is electrically conducting.

24. A system of electric circuits comprising:

a first element according to any of claims 1 to 23, said first element comprising at least one exposed conductor connected to at least one of the one or more electric circuits, and

a second element comprising one or more electric conductors whereof at least one conductor is exposed,

wherein one of the first or second elements comprises a recess comprising an exposed conductor of the element, and the other of the first or second element comprises a first part for introduction into said recess, said first part comprising an exposed conductor of the element, and wherein introduction of the first part into the recess establishes an electrically conducting connection between the exposed conductor of the first element and the exposed conductor of the second element.

25. A system according to claim 24, wherein the second element comprises:

an outer elongated tubular member having a longitudinal axis, and

one or more inner elongated tubular members coextending inside the outer tubular member, said outer and inner tubular members being physically separated from each other.

26. A system according to claim 24, wherein the second element is an element according to any of claims 1 to 23.

27. A system according to claim 24, wherein the second element is a flat element having an at least substantially planar first surface, said second element comprising two or more layers of conducting material.

28. A system according to claim 27, wherein the two or more layers of conducting material have an extent at least substantially corresponding to the extent of the first surface and wherein the layers are separated by an at least substantially electrically insulating material.

29. A system according to claim 27 or 28, wherein the second element further comprises one or more channels for holding and/or conducting a gas or a liquid, said one or more channels extending at least substantially parallel to the first surface.

30. A system according to any of claims 27 to 29, wherein

the second, flat element comprises the recess comprising an exposed part of one or more conducting layers of the second element, and

the first tubular element comprises the first part for introduction into the recess of the second element, said first part comprising an exposed conductor connected to at least one of the one or more circuits of the first element

31. A system according to any of claims 27 to 29, wherein

the first tubular element comprises one or more recesses at least one of which comprises an exposed conductor connected to at least one of the one or more circuits of the first element, and

the second, flat element comprises one or more first parts for introduction into one or more of the recesses of the first element, at least one of said first parts comprising an exposed part of one or more conducting layers of the second element.

32. A system according to any of claims 24 to 31, further comprising a third element comprising one or more electric conductors whereof at least one conductor is exposed, and

wherein the second element comprises at least two exposed conductors, and

one of the second or third elements comprises a recess comprising an exposed conductor, and the other of the second or third element comprises a first part for introduction into said recess, said first part comprising an exposed conductor of the element, and wherein introduction of the first part into the recess establishes an electrically conducting connection between the exposed conductor of the third element and the exposed conductor of the second element.

33. A system according to claim 32, wherein at least one of the one or more conductors of the second element provides an electric connection between one or more circuits of the first element and one or more conductors of the third element.

34. A system according to claim 32 or 33, wherein the third element is an element according to any of claims 1 to 23.

35. A system according to any of claims 24 to 34, wherein the electrically conducting connection between the first and second element is adapted to conduct an electric signal from the exposed conductor of the second element to at least one of the one or more electric circuits of the first element or to the exposed conductor of the second element from at least one of the one or more electric circuits of the first element.

36. A system according to claim 35, wherein the electric signal is an analogue signal.

37. A system according to claim 35, wherein the electric signal is a digital signal.

38. A system according to any of claims 24 to 37, wherein:

the first element comprises at least two exposed conductors each connected to at least one of the one or more circuits, and

the second element comprises two or more electric conductors whereof at least two conductors are exposed, and

the recess comprises at least two exposed conductors and the first part comprises at least two exposed conductors, and

introduction of the first part into the recess establishes electrically conducting connections between at least two pairs of an exposed conductor of the first element and an exposed conductor of the second element.

39. A system according to claim 38, wherein the at least two exposed conductors of the second element are connected to an electric power supply, and wherein the at least two

electrically conducting connections are adapted to supply electric power to the at least one of the one or more electric circuits of the first element.

40. A set of elements comprising:

a first element according to any of claims 1 to 23,

a second element comprising two or more electric conductors, the second element further comprising a third connection portion comprising one or more exposed conductors,

the first element comprising a first and a second connection portion for connecting one or more electric circuits of the first element to one or more electric circuits of the second element, each connection portion comprising one or more exposed conductors connected to one or more circuits of the first element,

the first and the third connection portions being adapted to engage each other so as to electrically connect one or more of the exposed conductors of the first connection portion to one or more of the exposed conductors of the third portion so as to form a first circuit from one or more of the circuits of the first element and at least one of the conductors of the second element,

the second and the third connection portions are adapted to engage each other so as to electrically connect one or more of the exposed conductors of the second connection portion to one or more of the exposed conductors of the third portion so as to form a second circuit from one or more of the circuits of the first element and at least one of the conductors of the second element, and

wherein the first and the second circuits provide different functions/functionality/effects/outputs/responds.

41. A set of elements according to claim 40, wherein the second element is an element according to any of claims 1 to 23, the one or more exposed conductors of the second element are connected to one or more of the circuits of the second element, and

wherein the first and the third connection portions are adapted to engage each other so that the first circuit comprises one or more of the circuits of the first element and one or more of the circuits of the second element, and

the second and the third connection portions are adapted to engage each other so that the second circuit comprises one or more of the circuits of the first element and one or more of the circuits of the second element.

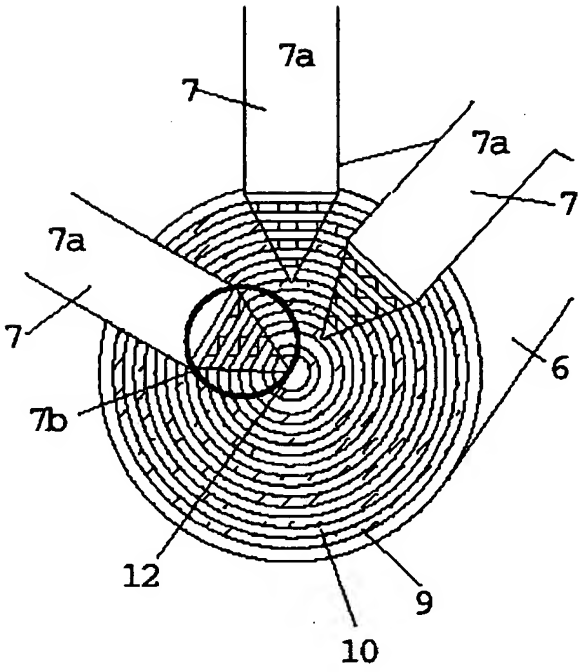


Fig. 1A

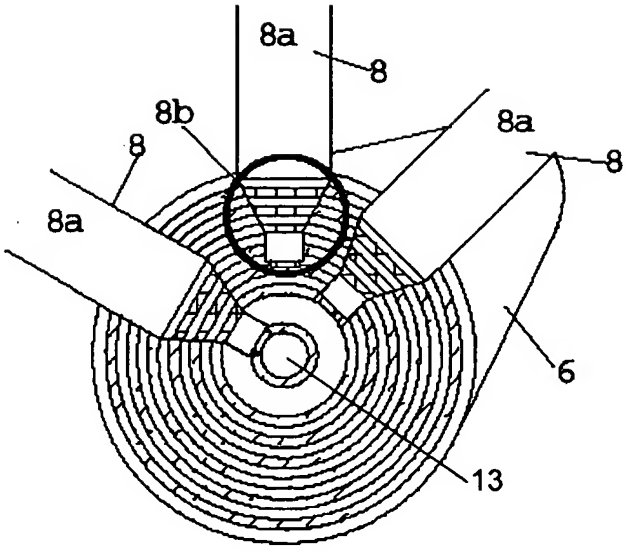


Fig. 1B

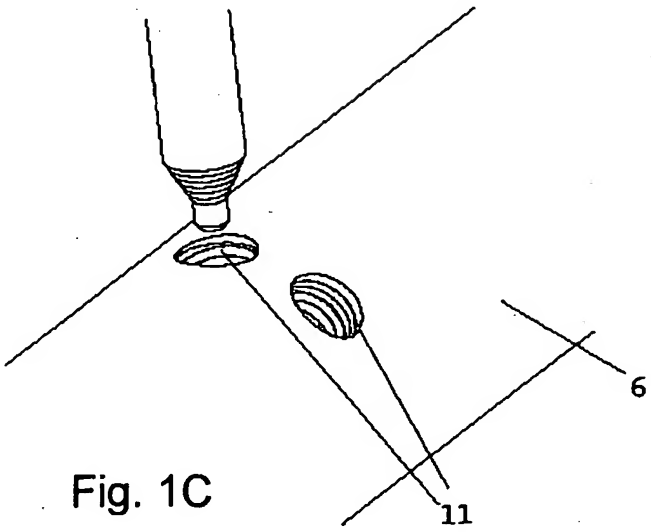


Fig. 1C

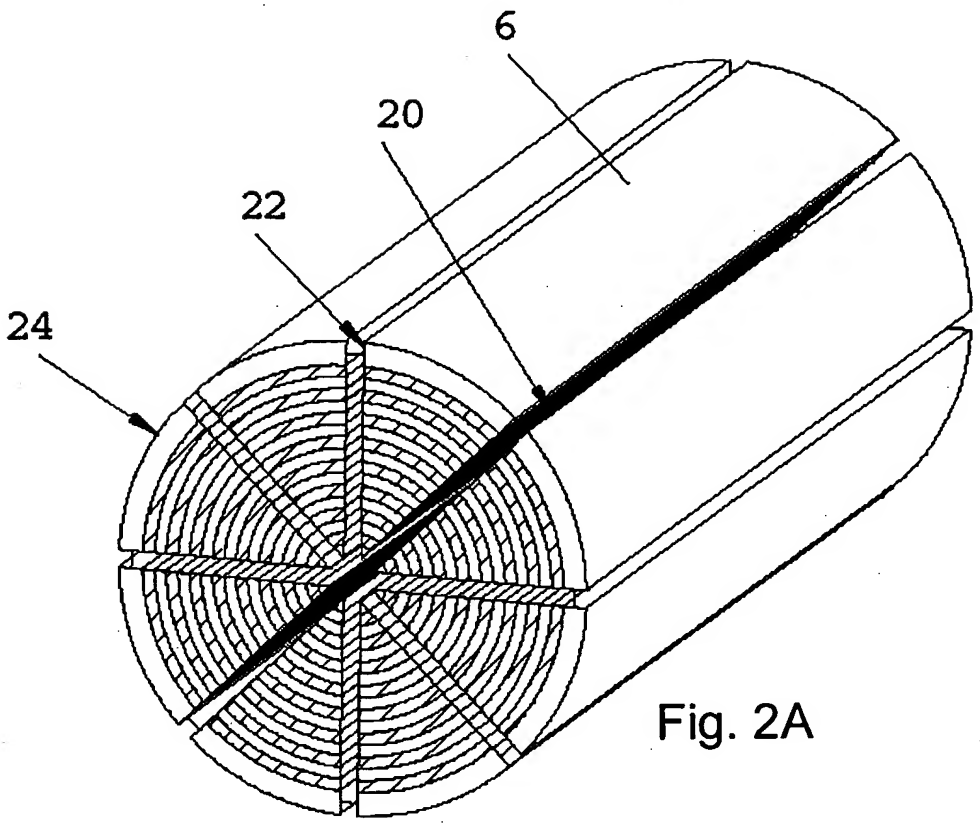


Fig. 2A

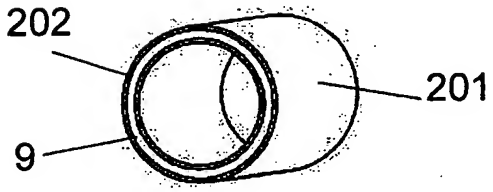


Fig. 2B

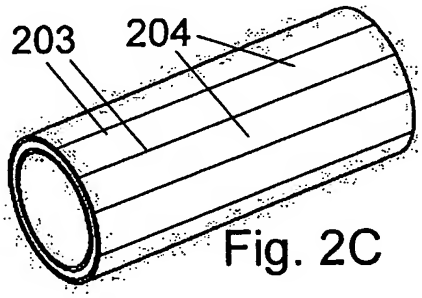


Fig. 2C

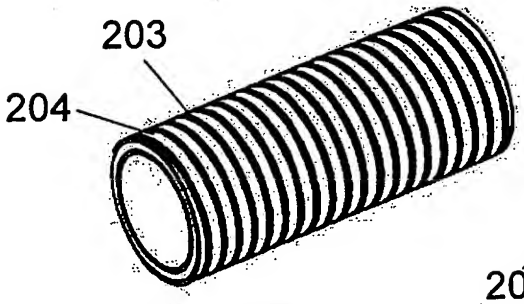


Fig. 2D

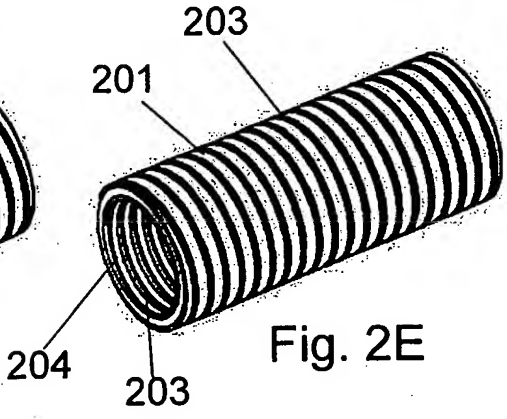


Fig. 2E

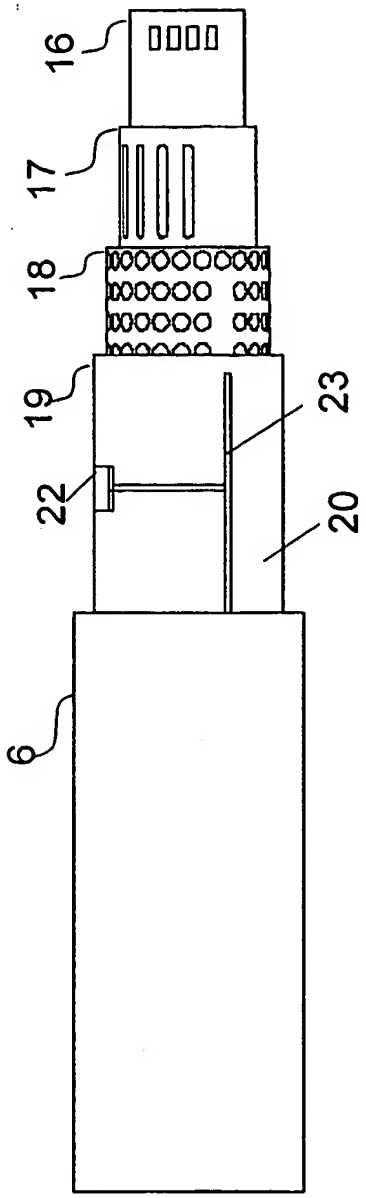


Fig. 3A

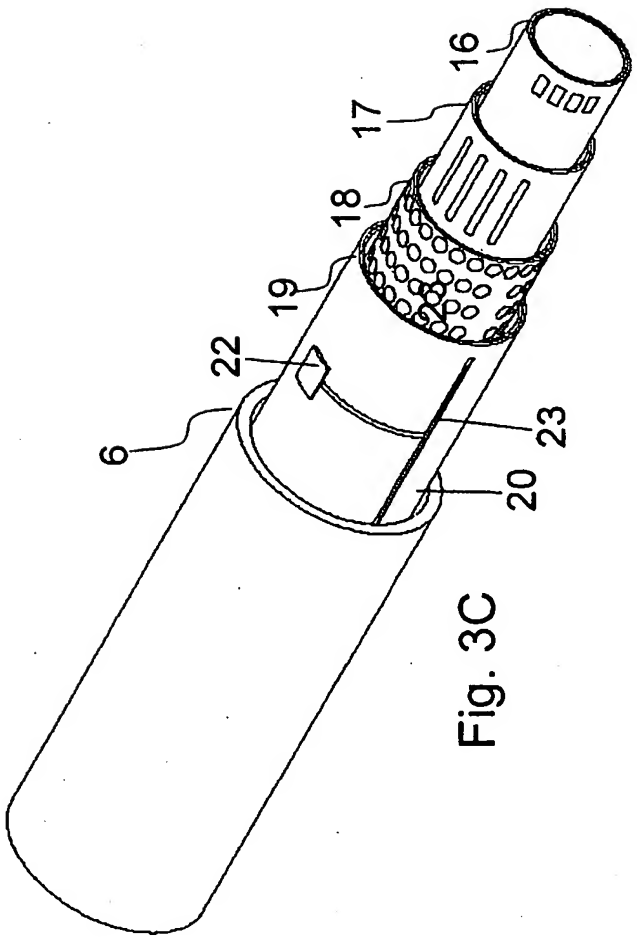


Fig. 3C

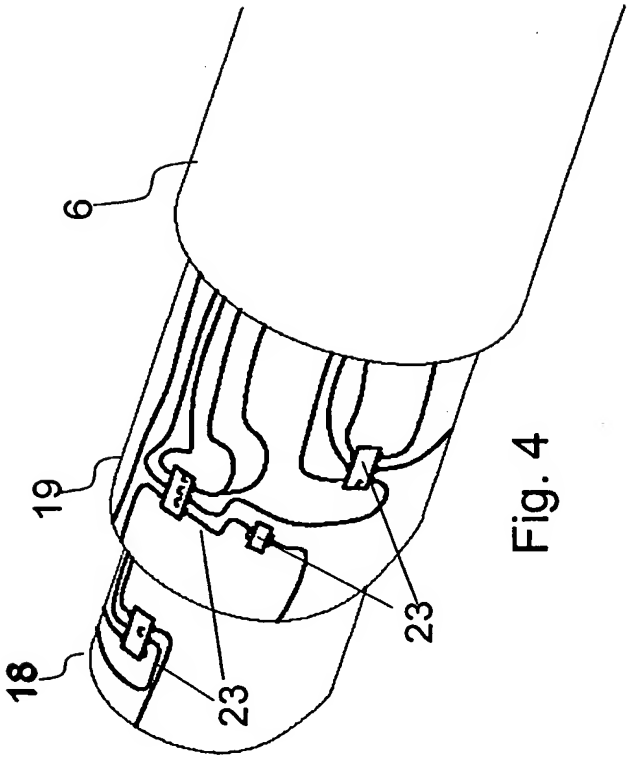


Fig. 4

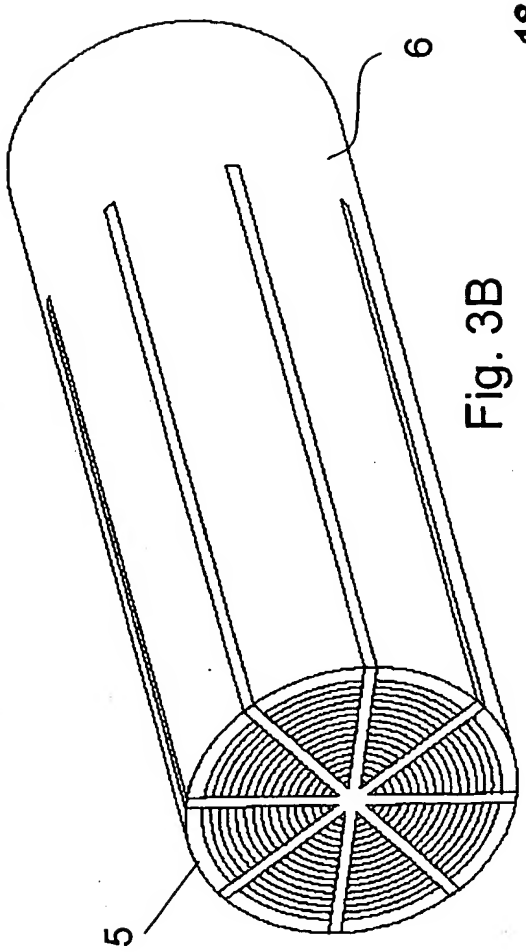


Fig. 3B

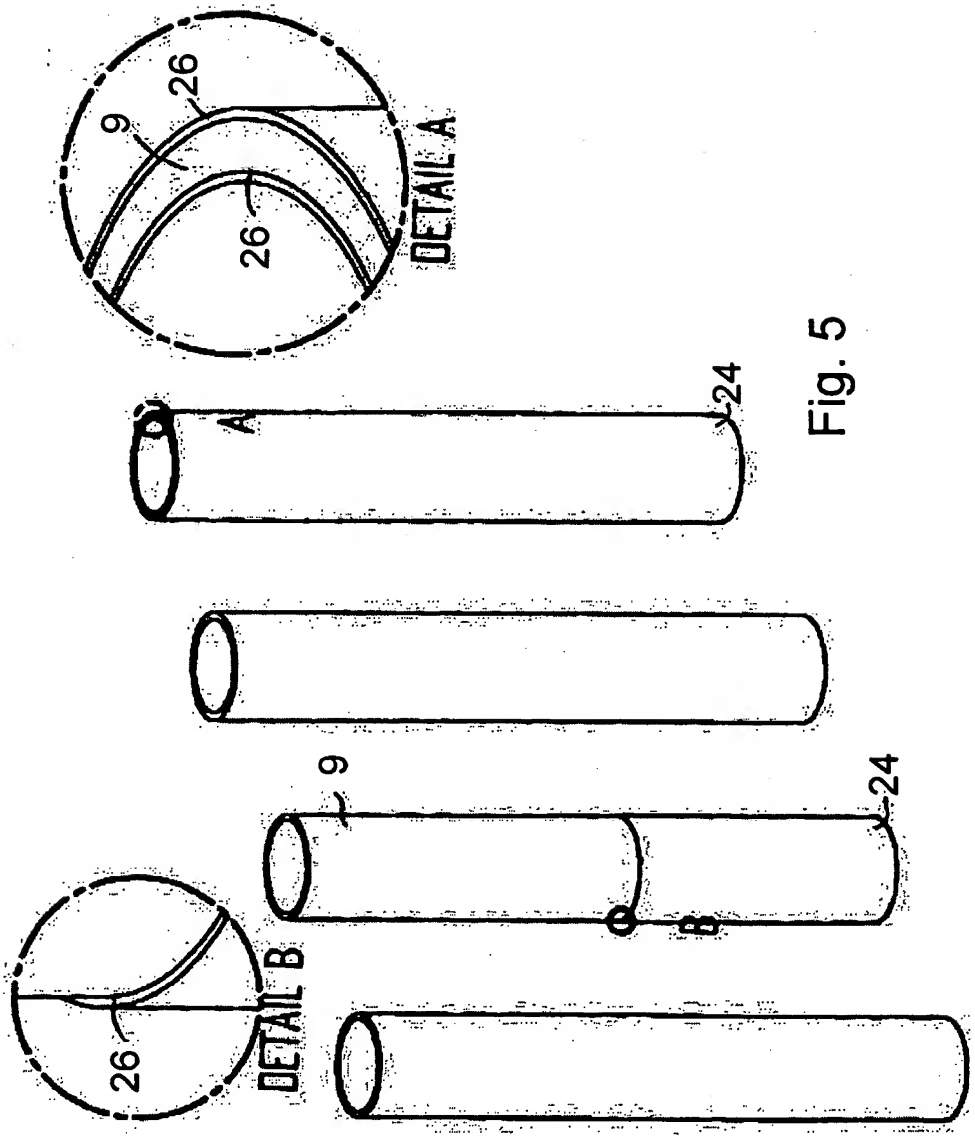
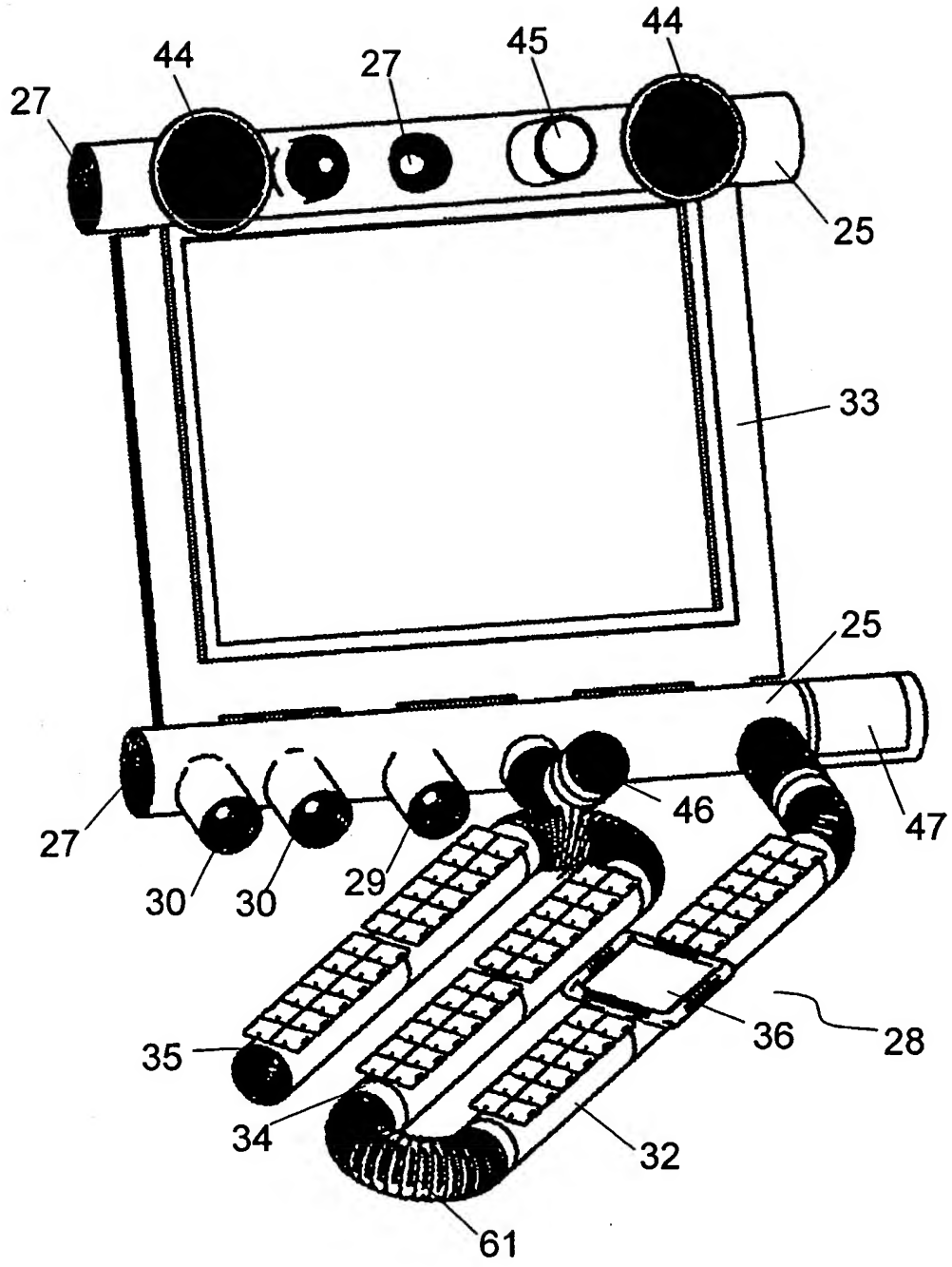


Fig. 5



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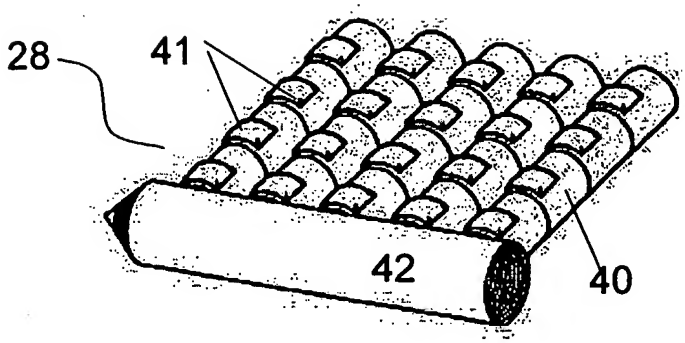

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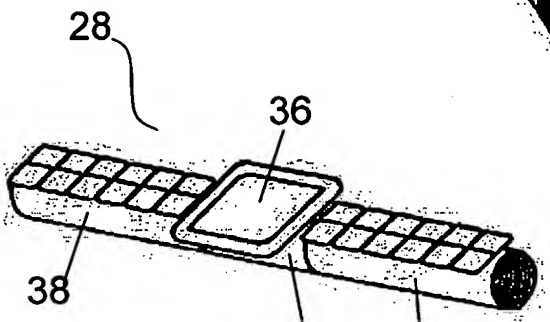

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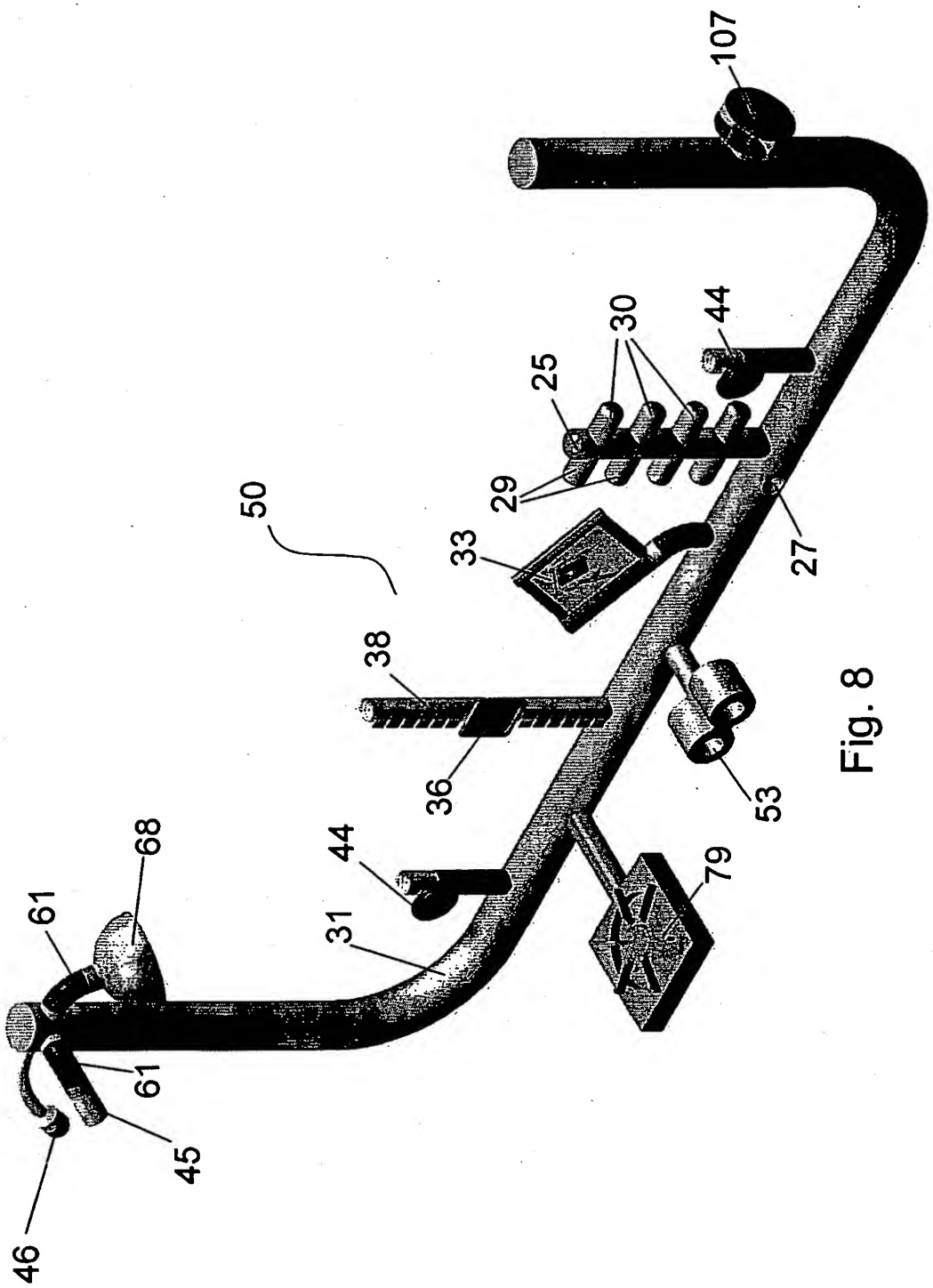

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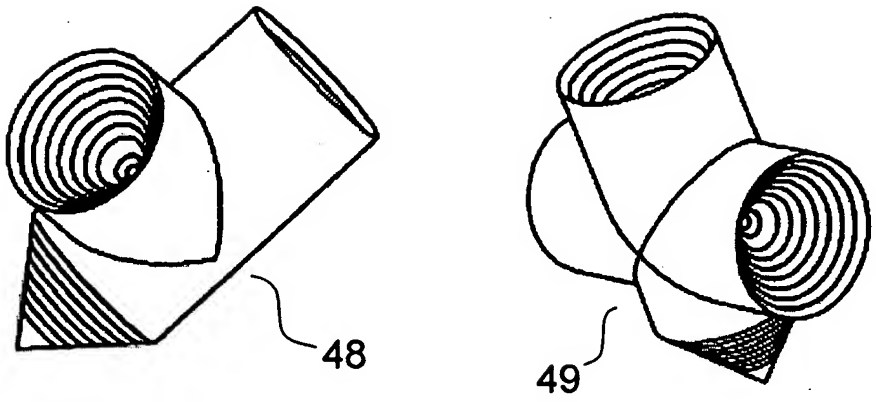

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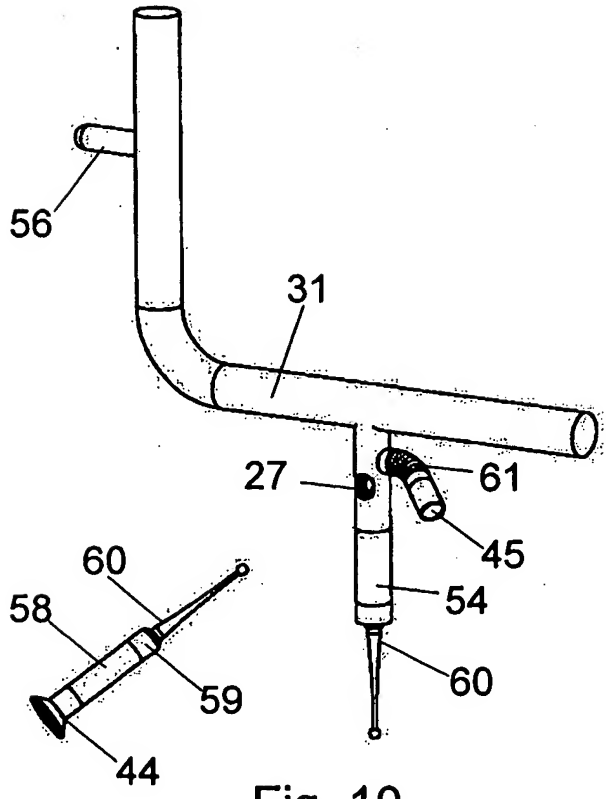

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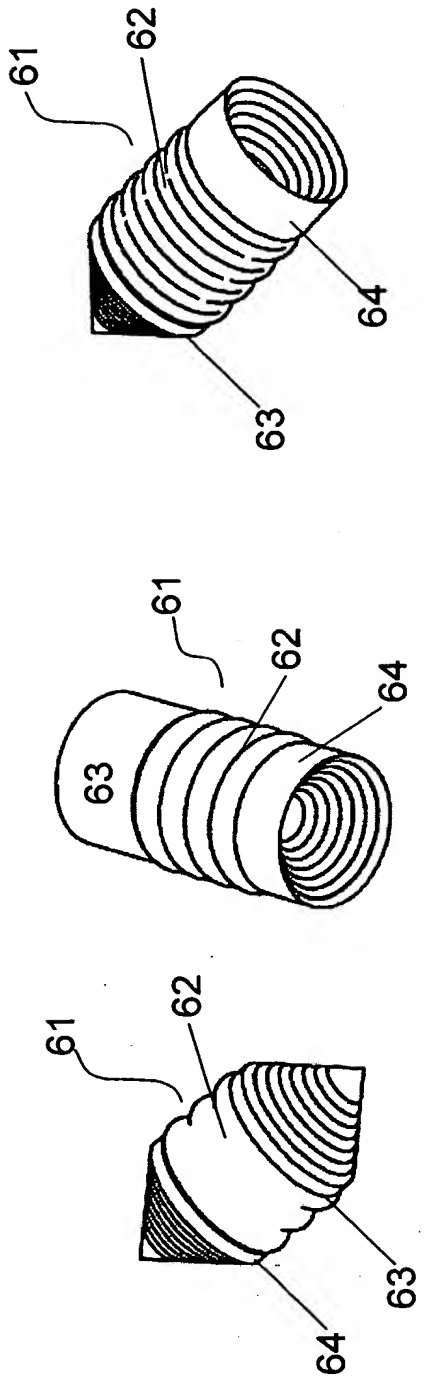

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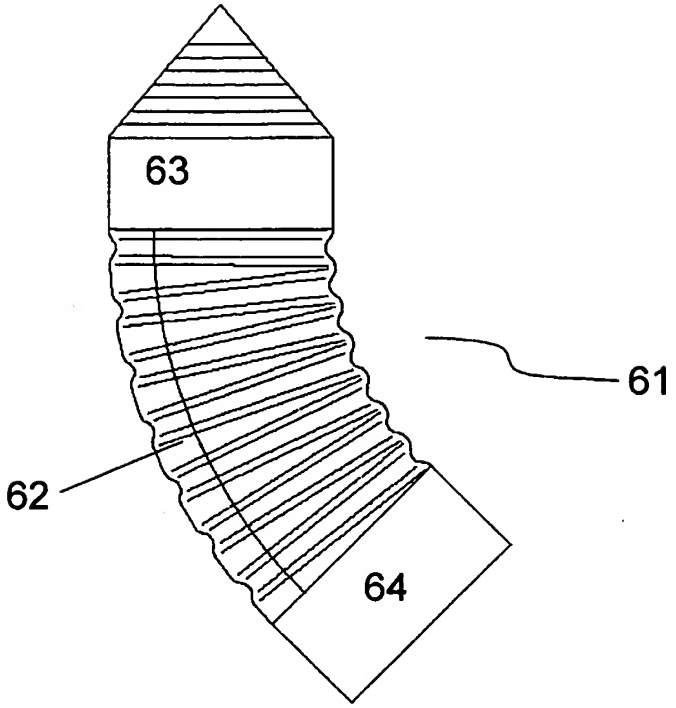

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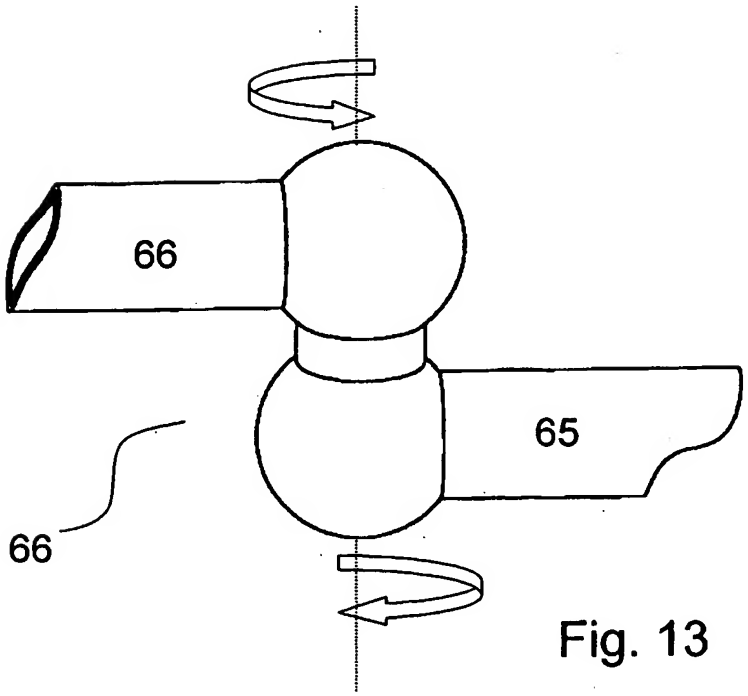

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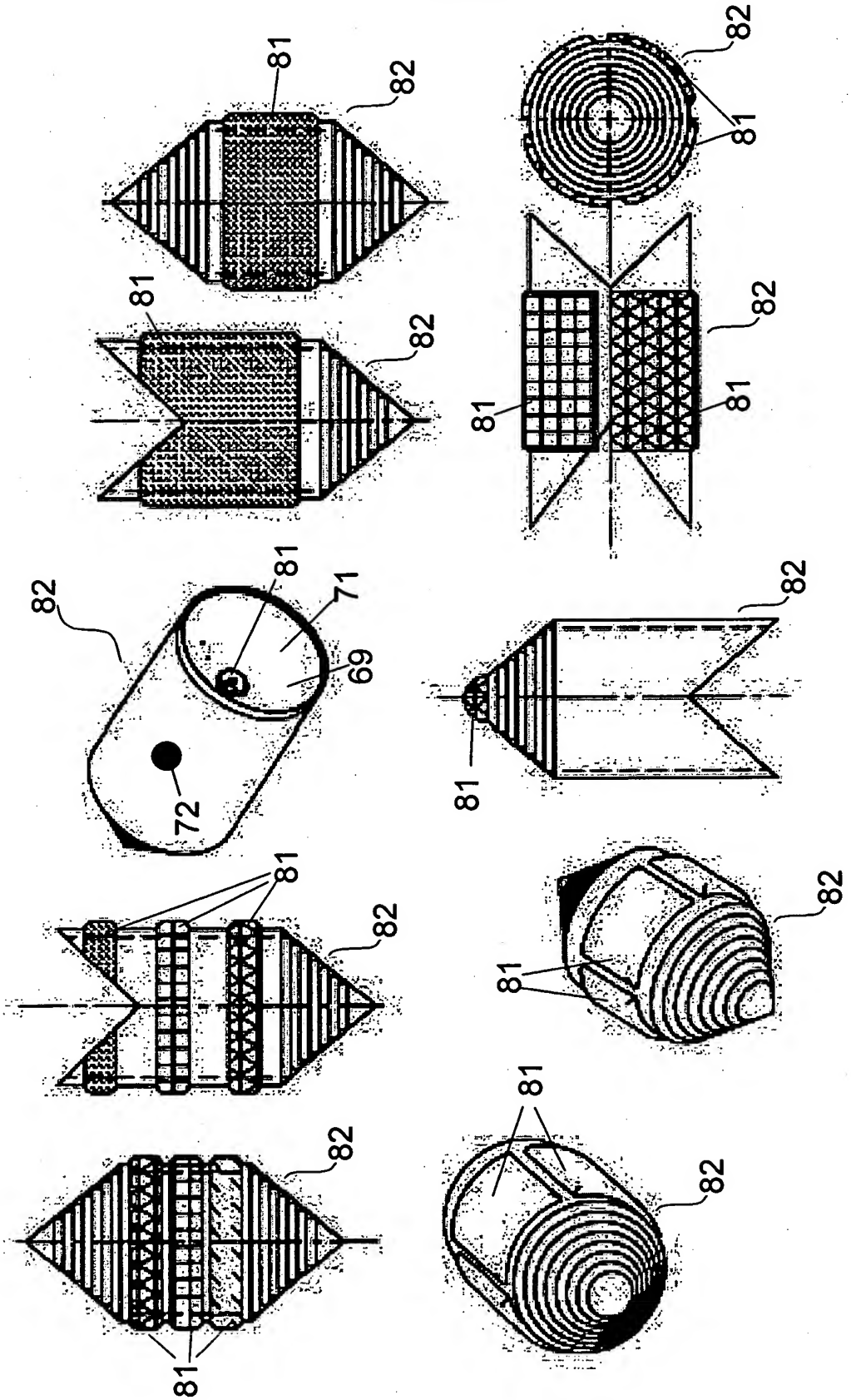

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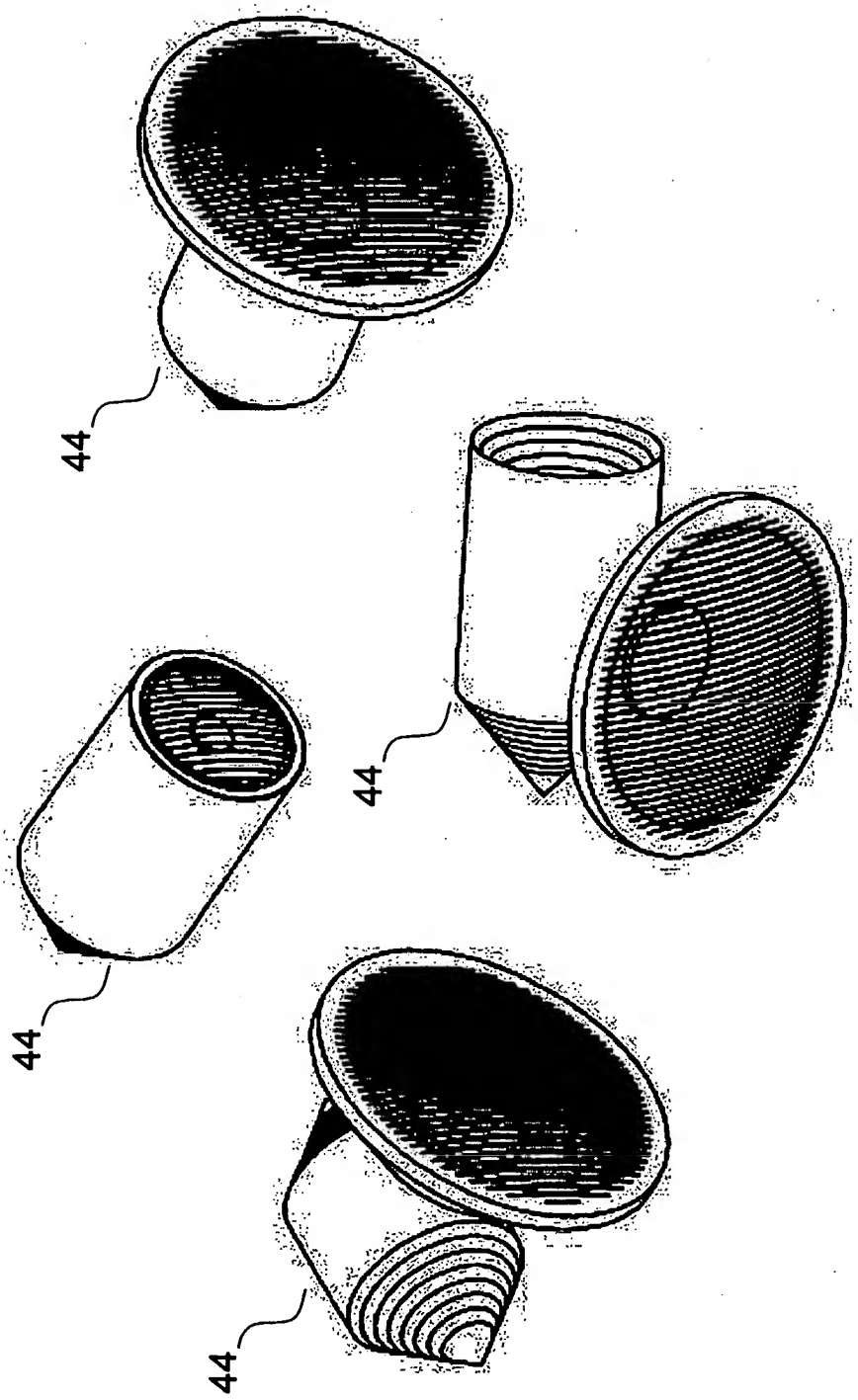

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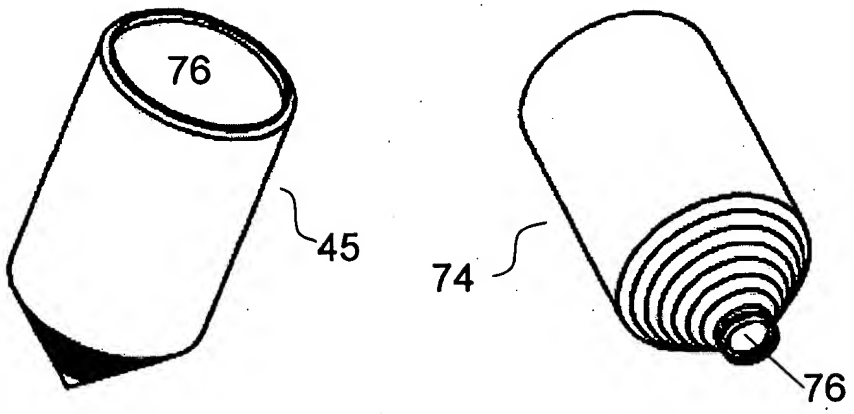

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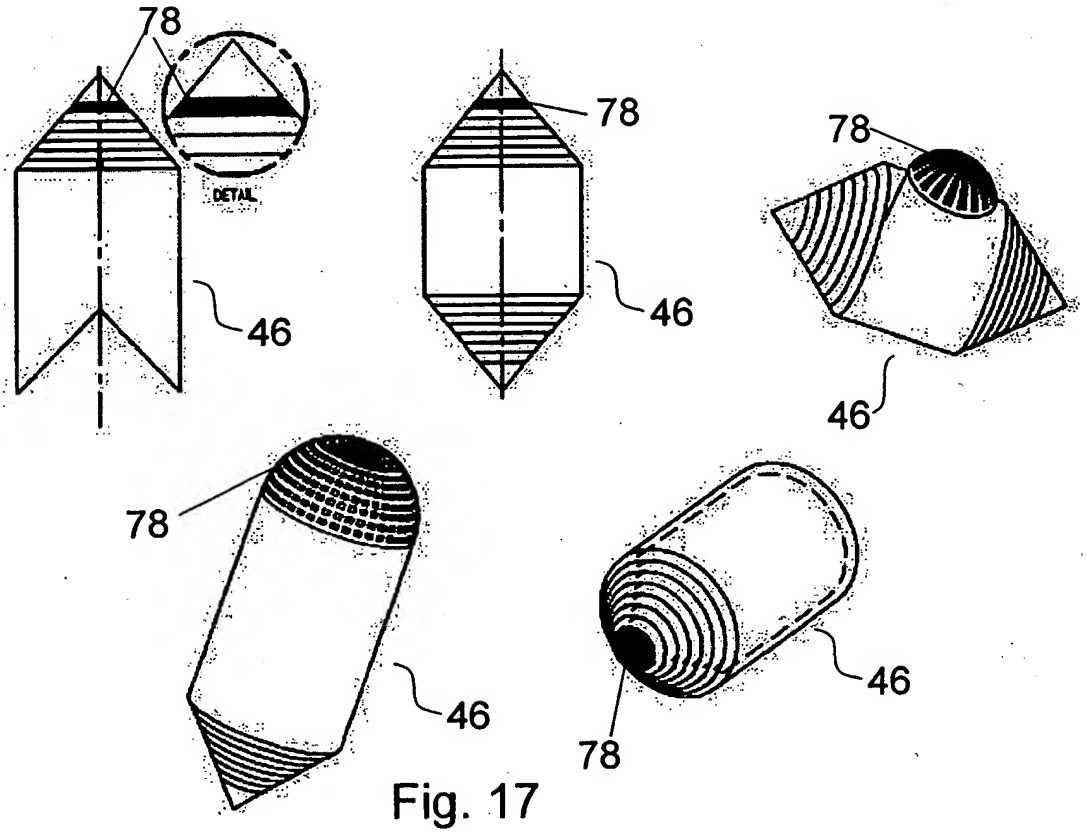

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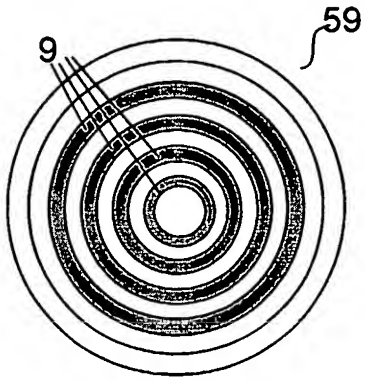

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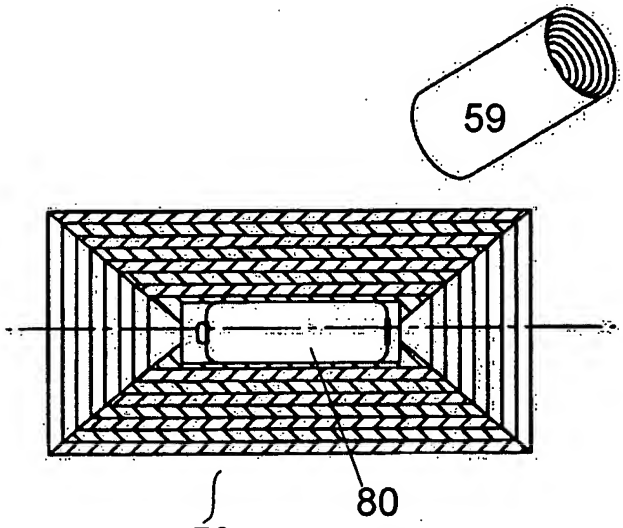
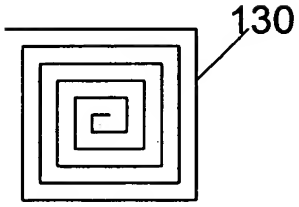


Fig. 18C



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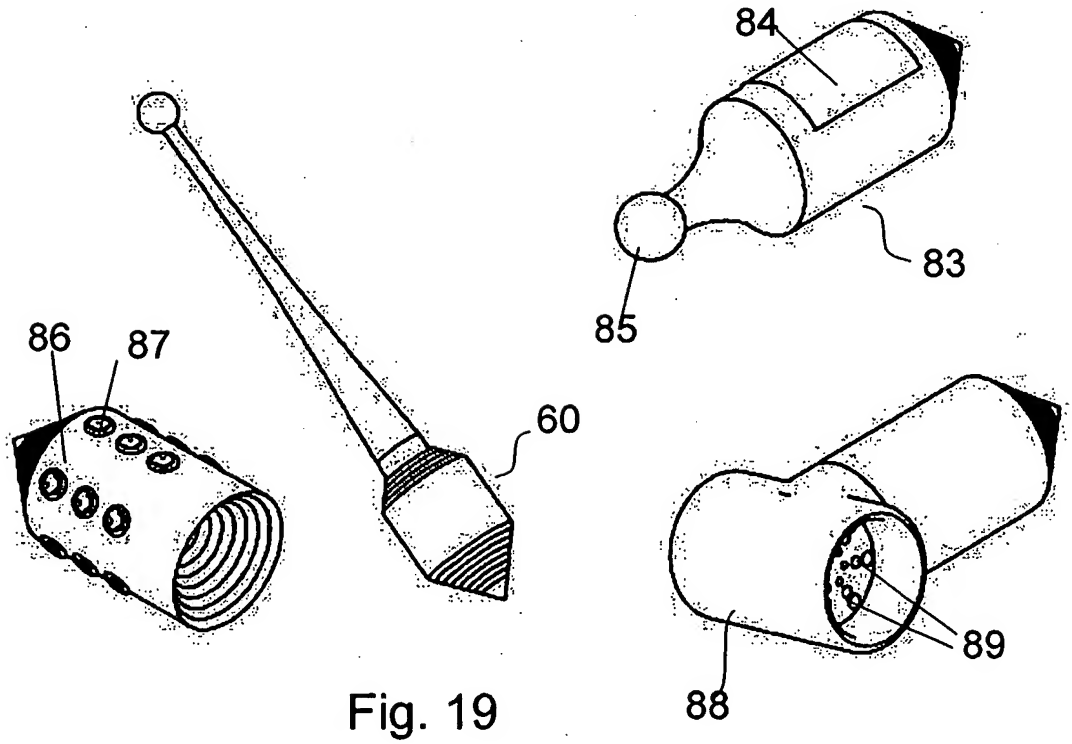

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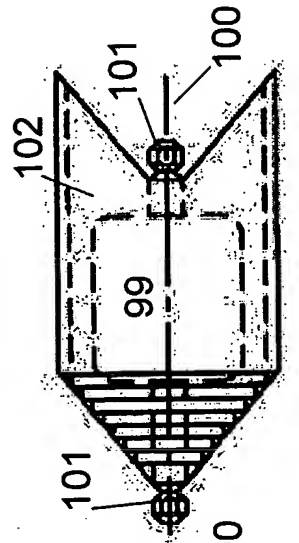
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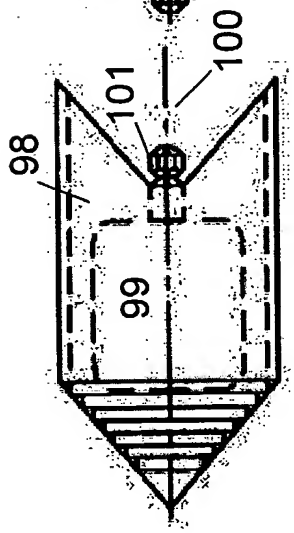
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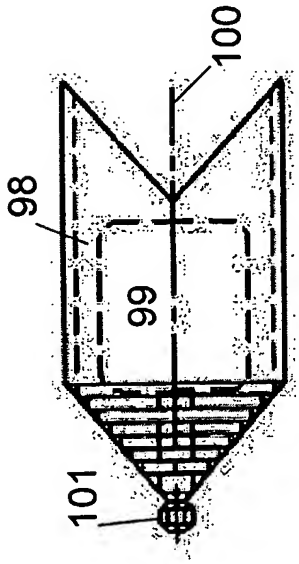
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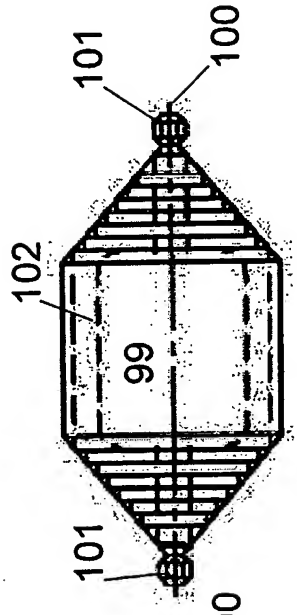
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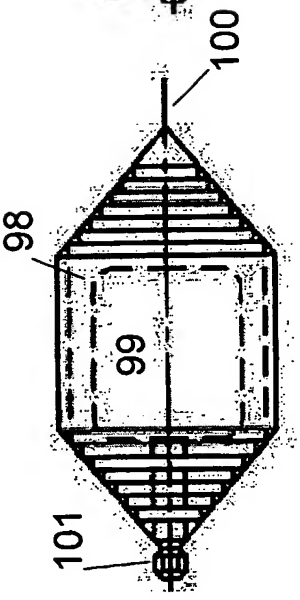
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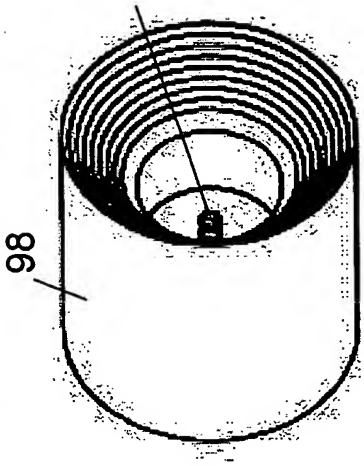
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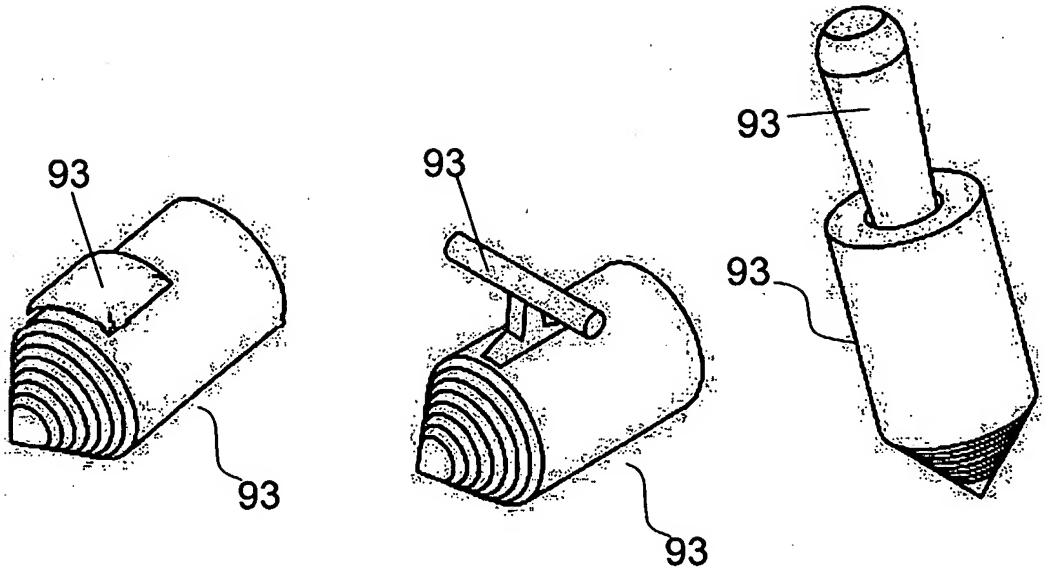

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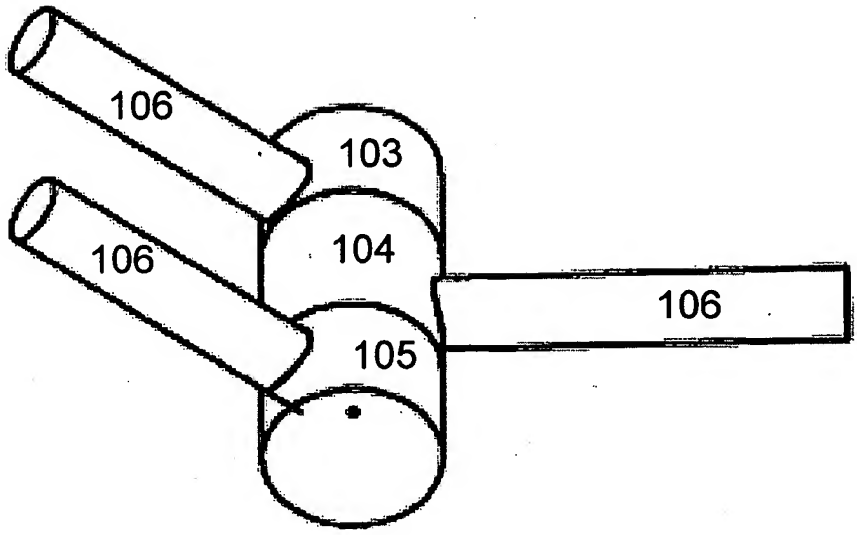

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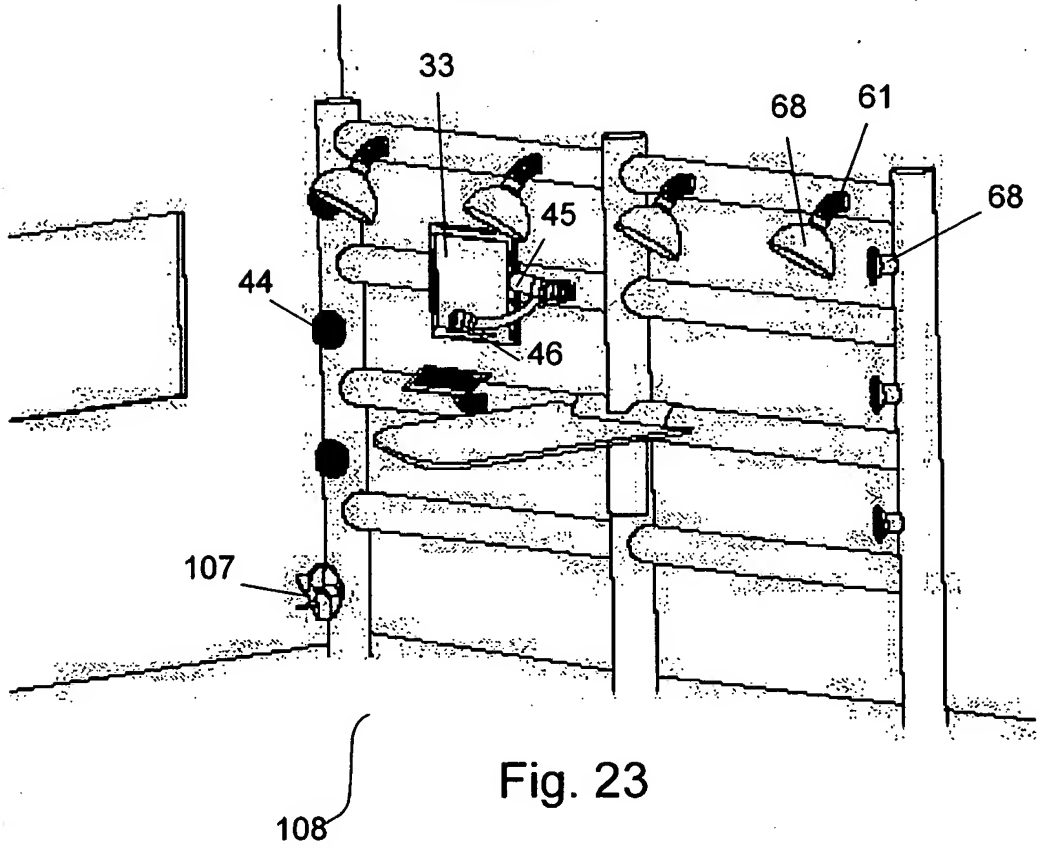

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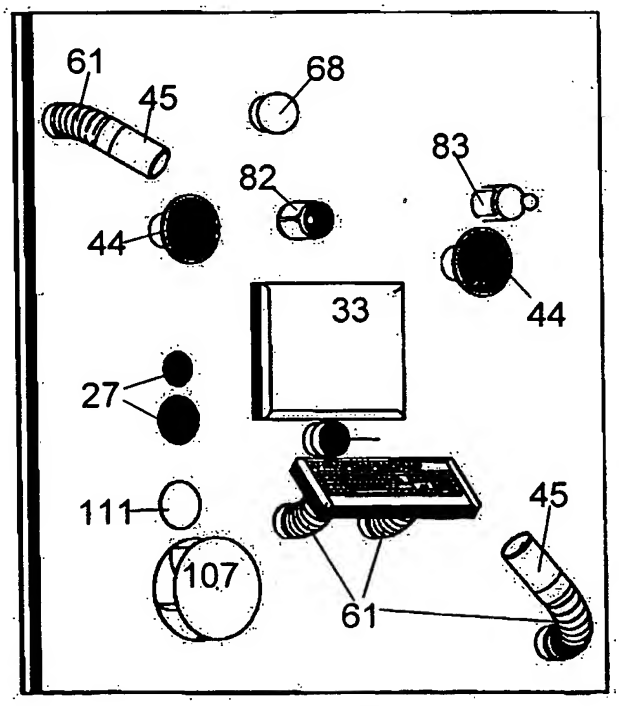

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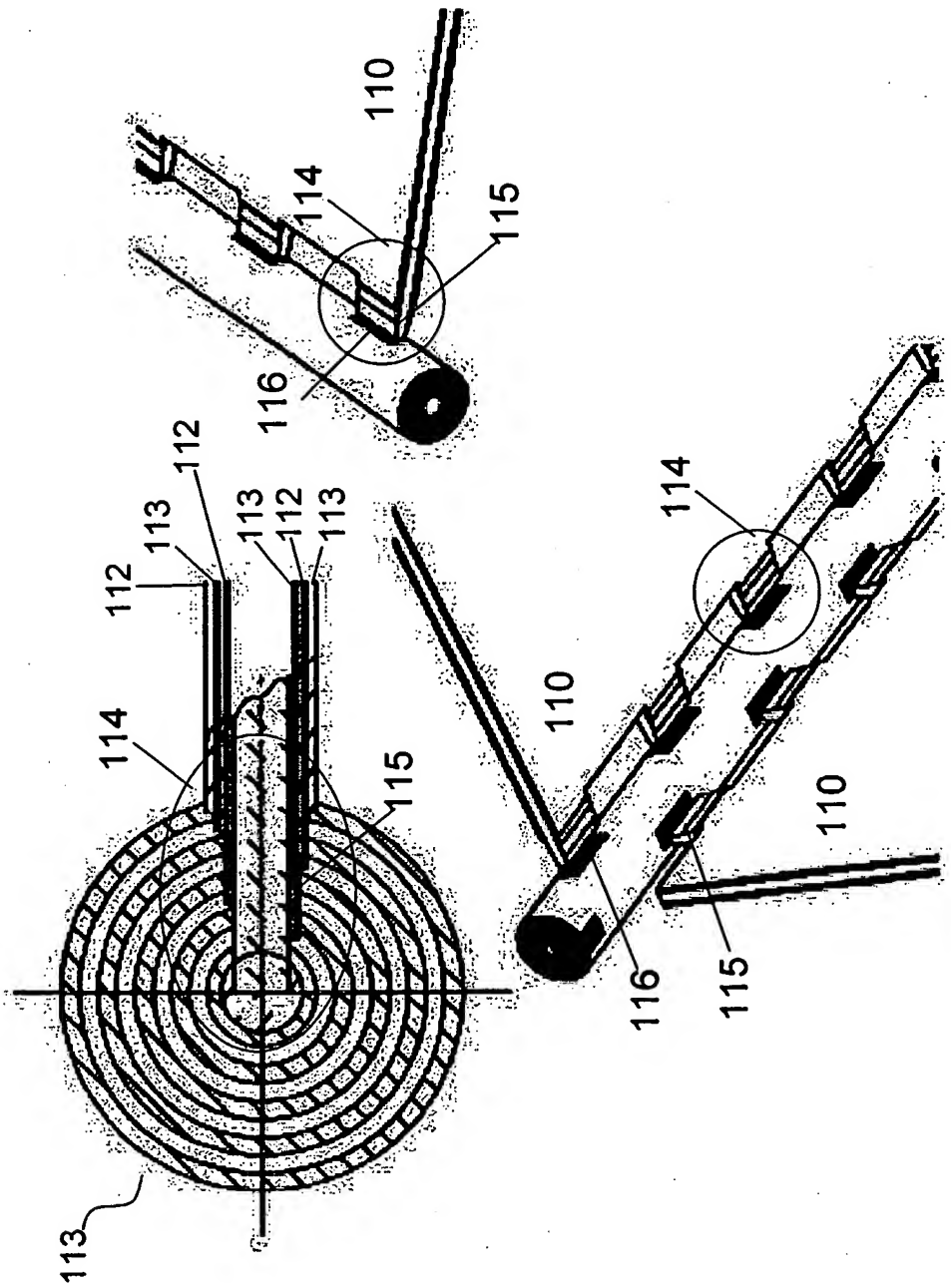
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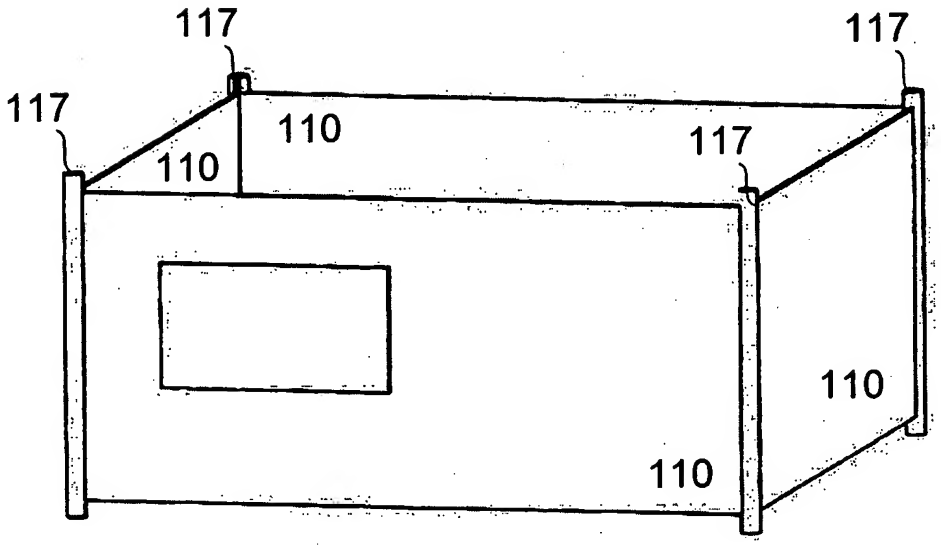
Fig. 25



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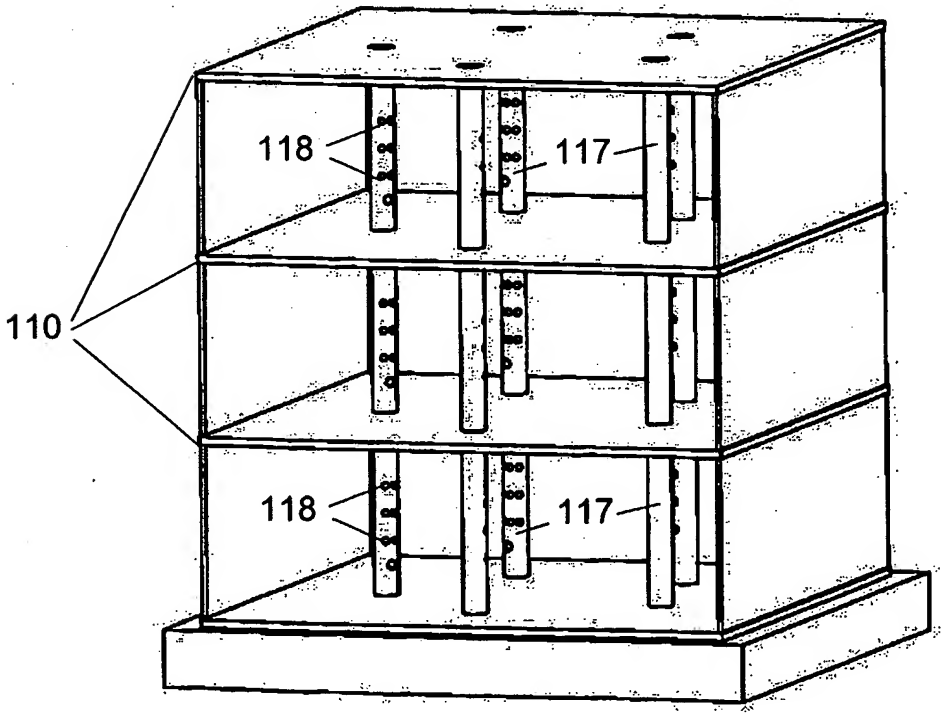

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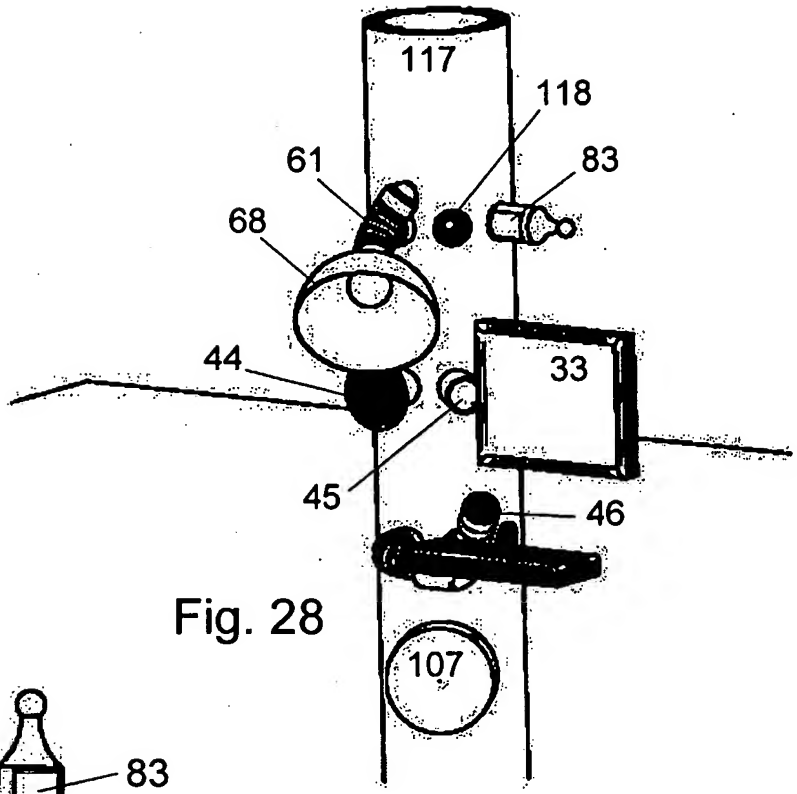

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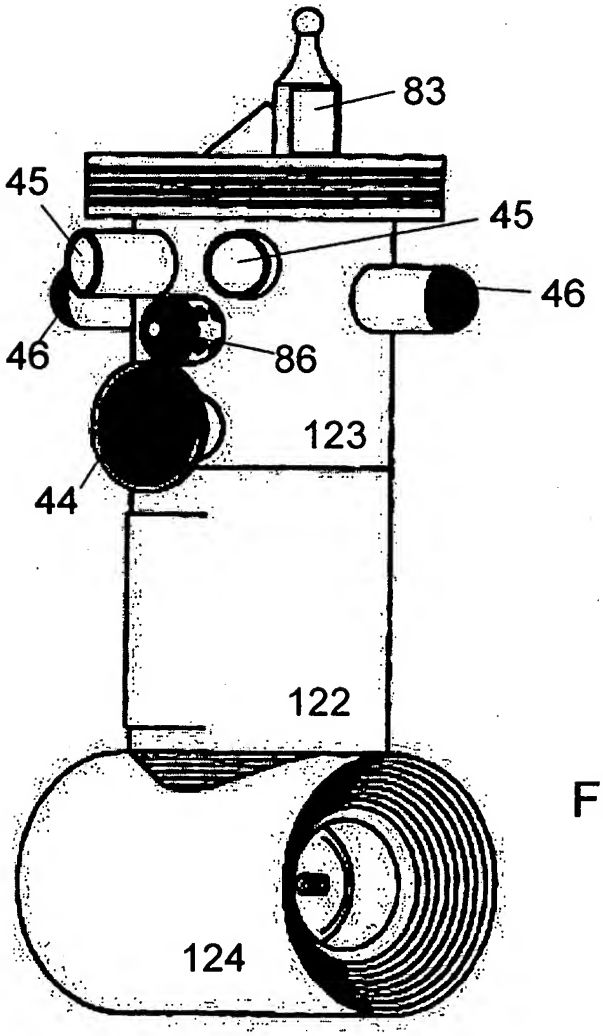

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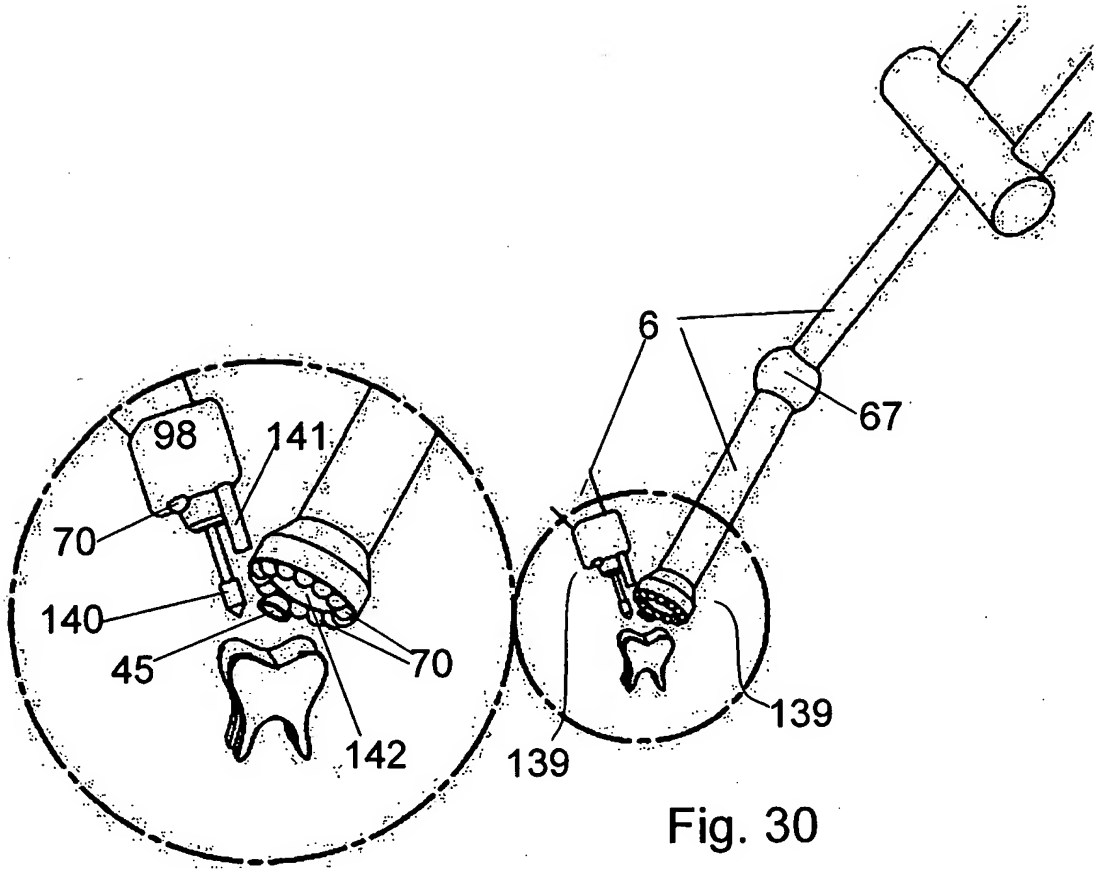

Fig. 30

INTERNATIONAL SEARCH REPORT

National Application No
PCT/DK 01/00266

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01R24/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	WO 90 11471 A (KAEHOENEN MATTI) 4 October 1990 (1990-10-04) the whole document	1
X A	WO 99 49476 A (REIPUR TECHNOLOGY A S ;REIPUR JOHN (DK)) 30 September 1999 (1999-09-30) the whole document	1
X	WO 95 34783 A (TIVOLI IND INC) 21 December 1995 (1995-12-21) the whole document	1
X	US 4 746 307 A (JOLY JEAN ET AL) 24 May 1988 (1988-05-24) abstract the whole document	1

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[X] Further documents are listed in the continuation of box C. [X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
9 July 2001	20/07/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Salojärvi, K

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/DK 01/00266

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 4 074 924 A (LEBECQUE MAURICE G N G) 21 February 1978 (1978-02-21) the whole document -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/DK 01/00266

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